AMERICAN GAS JOURNAL

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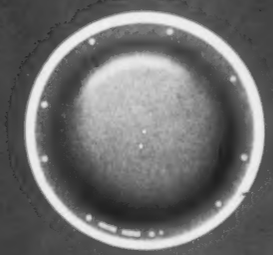

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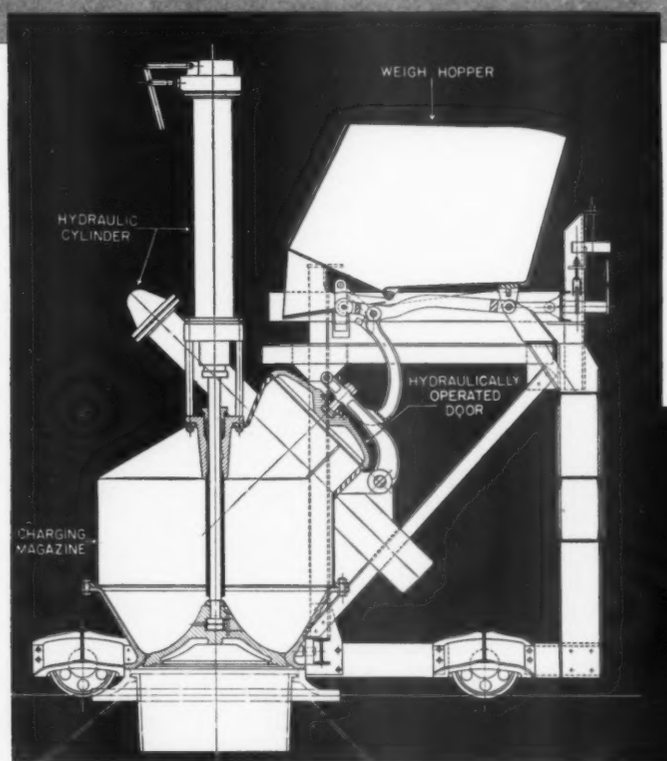
Clark Bros Co.

SEMET-SOLVAY *Automatic* CHARGING MACHINE



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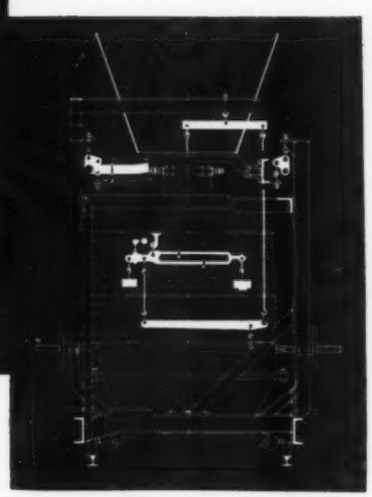

At least ten per cent increase in capacity of your water gas machine can be obtained by the addition of a Semet-Solvay Automatic Charging Machine. Part of the increase is obtained by eliminating shut-downs for charging, part from the added efficiency of a fuel bed of constant depth.

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SEMET-SOLVAY ENGINEERING CORPORATION

40 Rector Street — **New York, N. Y.**

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1651

TINNED STEELCASE METERS

DECEMBER
1941

AMERICAN
GAS JOURNAL

VOLUME 155
No. 6

Priorities

INTEREST of the gas companies and appliance manufacturers is now focused on the expected orders of the Office of Production Management which are almost certain to restrict the production of gas ranges and other gas burning appliances in the future. What provisions will be embodied in those orders is, of course, not yet known; but certain informed persons seem to expect a reduction of as much as 40 per cent in the number of appliances available.

To understand this situation, it must be appreciated that the present trend is away from a direct priorities basis to an industry allotment basis for critical materials. The OPM would like to make this transition gradually, with the result that both priorities and allotment plans may be in operation simultaneously for a while.

Of course, should the OPM restrict the number of units the gas appliance manufacturers may make, that does not necessarily mean that they will be able to get the required materials to make them. If operating under a priorities system, that would depend on what rating they can get, which in turn would depend on whether the units were to go for defense housing or to some other preferred class of customer. Under an industry allotment system, on the other hand, a certain amount of material would be assigned to the members of that industry. The restriction as to maximum production would act as a ceiling in either case.

Perhaps the most serious danger lies in the suggestion that appliance design might be stipulated or restricted by the government. This would be a misguided effort to save material; and if it should go further than at present, every member of the gas industry might well protest against it. For years the A. G. A. Laboratory has been striving to improve the safety, efficiency and soundness of construction of gas appliances. In this it has had the approval and cooperation of the National Bureau of Standards, which was a pioneer in the efforts to improve the safety of gas utilization. Any changes now required must almost necessarily be detrimental. They would almost necessarily involve the making of new dies, with consequent use of material, tools and labor.

We believe the following should be urged:

(1) **Give the gas appliance manufacturers the quantities of the various kinds of materials to which they are entitled; and let them use those materials to make as many safe, sound and efficient appliances as they can.**

(2) **Freeze all gas appliance designs of each manufacturer as they are at present.**

(3) **Restrict the number of models each manufacturer can produce.**

(4) **Facilitate the production of repair parts for models now in service.**

A new angle bearing on all of this was brought into the priorities and allotment situation by Senator Joseph C. O'Mahoney of Wyoming, who has introduced a bill (S 1847) to provide for hearings on applications of all industrialists for raw materials.

A statement given out by Senator O'Mahoney is as follows:

"Senator David I. Walsh, Chairman of the Committee on Naval Affairs, has advised me that he is calling the Naval Affairs Committee to meet on Tuesday, November 25, (postponed until Dec. 1st) to consider my bill (S. 1847) providing for the establishment of an agency before which civilian business may have a hearing on its applications for raw materials.

"Public demand throughout the United States is rising rapidly for the enactment of legislation of this character because it is recognized that an independent economy cannot exist if little business is allowed to die for want of materials.

"I shall ask the Committee for an opportunity to appear in order to make my argument that it is not at all necessary to cripple normal civilian industry in order to provide for national defense.

"I would give every defense contractor all the materials which he needs to carry out all our commitments under the lease-lend act and fully to provide for our Army and Navy and I think I can demonstrate that this can be done without putting civilian industry out of business.

"The principle is simple, let us give defense contractors all of the raw materials they can use within any reasonable period, but let us not starve little business by permitting

the accumulation of materials which cannot possibly be used by defense contractors for a year or more.

"I am told on the best of authority that many of the big industries engaged in defense output have inventories more than 25% above normal. That means that they are holding for future use the materials for lack of which many little businesses will die.

"A policy of stripping little business of needed materials in order to provide excess inventories for defense contractors overlooks entirely the capacity of this country to produce and to import raw materials.

"It is a plain policy of defeatism to acquiesce in the crippling of civilian business in order to provide for future needs of war industry. It is a surrender to the totalitarian ideal.

"We are making ourselves the arsenal of democracy in order to preserve free enterprise, a free economy and political liberty. We cannot hope to do this if we risk the destruction of little business.

"I believe that the productive capacity of the United States and the will to victory of her people is such that we can deliver the materials necessary to supply all our military needs as rapidly as we can make them and, at the same time, preserve little business. One of the chief benefits of the bill I have introduced is that it will provide for public hearings. When Congress legislates it legislates in the full glare of publicity. The same rule should apply to OPM and SPAB. The decisions which are taken by the defense organization affecting the entire economy of America should be taken in public where all will know in advance what is proposed and how it is to be done.

"Any other course would be a confession that the democratic system cannot work.

"We are depending upon the impairment of civilian morale in Germany and Italy to help overthrow the dictators. We know that this morale is being undermined because civilian activity is being suppressed.

"The answer of democracy to totalitarianism is to show that a vigorous, active democratic economy can preserve civilian morale and at the same time produce the materials needed to crush totalitarianism.

"The bill, S. 1847, was sent to the Naval Affairs Committee because it is an amendment to the Act of June 28, 1940 which contained the first provision respecting priorities and which was reported by the Naval Affairs Committee."

Consideration of this bill may have the indirect effect of delaying other action with respect to priorities and allotments.

Meanwhile, on November 25th, the OPM defined what is meant by "minor improvements" and "minor capital additions" for utility systems covered by Preference Rating Order P-46.

Under this order a preference rating of A-10 is assigned to supplies needed for repair, maintenance and operation, and for "minor improvements" and "minor capital additions." This led to uncertainty among utilities as to what constituted "minor improvements" or "minor capital additions."

Amendment No. 2 to P-46, issued today, puts an end to the uncertainty by providing that a minor improvement or minor capital addition is an expenditure for material not exceeding $1500 in the case of underground connections, or $500 for other capital additions. A job may not be split up in order to come within those limits.

Another clause in the amendment liberalizes the acquisition or withdrawal of supplies needed to repair property or equipment damaged by fire, flood, or other climatic occurrences.

Other provisions in the amendment clarify sections in the original order with respect to replacement of condemned meters and acquisition of additional meters to serve new business.

OPM Issues General Allocation Order No. 1—Steel Plates Effective December 1, 1941

Complete allocation of steel plates was ordered December 1st by Donald M. Nelson, Director of Priorities, in General Allocation Order No. 1.

The action is the first step in compliance with the request of the Supply, Priorities and Allocations Board, made November 1, that a direct allocation system for steel be worked out.

Defense demands for steel plates are heavy, the Army, Navy and Maritime Commission taking approximately 50 per cent of existing capacity. Other leading users are the railroads, for car construction, and the petroleum industry, for pipe and in the construction of all types of tanks. There are many other general uses of plates.

As of November 1, reports from steel plate producers showed defense and essential civilian orders, with ratings of A-10 or higher, in excess of production capacity for shipment during the month. Capacity of the industry is about 600,000 tons a month.

The Order defines plates and provides that after December 1 no person shall produce, deliver or accept plates except in accordance with the orders of the Director of Priorities.

Producers are required to file with the Iron and Steel Branch, OPM, by the 15th of each month a schedule of production and shipments for the following month, together with a statement of unfilled orders for the period. They then will receive an allocation order from the Director of Priorities, making any changes that are deemed advisable.

Plates produced in excess of schedule cannot be disposed of except at the direction of the Director of Priorities.

The order also provides that suitable forms for producers and customers will be prescribed from time to time.

Immediate purpose of the order is to insure a continuous flow of plates into defense channels and to provide an adequate check against hoarding and excessive inventories.

Studies of steel plate requirements for non-defense industries now are being made by the Division of Civilian Supply in conjunction with the Division of Materials to determine what proportion of the available supply should be allocated to each. No direct allocations of this kind have yet been made, although substantial steps in this direction are being taken.

Steel has been under priorities control since May 1, 1941, when General Metals Order No. 1 was issued. General Preference Order M-21, issued May 29, has provided overall steel control since.

Experience with Nine Foot Reverse Flow Water Gas Machine*

By
George G. Dormer,
Plant Superintendent
Wisconsin Power and Light Company

CHEAP GRADES of heavy fuel oil have been used in water gas sets in the east for a number of years, but it was only with the development of the Michigan and Illinois oil fields that these products became available to us in the middle west at prices sufficiently low to attract our attention. Three years ago, the Wisconsin Power and Light Company's gas plant at Beloit, Wisconsin, consisted of two six foot, hand operated, backrun equipped UGI water gas sets installed in 1912, and one nine foot UGI water gas set with backrun, waste heat boiler and automatic control, installed in 1930.

Our daily sendout was approximately 1,100,000 cubic feet per day, of which approximately 45% was high pressure gas (40-55 pounds per square inch) and the remainder low pressure gas (2-4 pounds per square inch).

We were faced with the problem of how we could best reduce our gas production cost:

a. By using heavy oil in our present equipment, or
b. By installing a new nine foot water gas set designed to operate with heavy oil.

Reverse Flow Installation at Beloit, Wisconsin

We decided to install a 9′ x 8′ x 8′ Semet-Solvay Reverse Flow vater gas set, and in February 1940 completed this installation consisting of a standard generator, Reverse Flow carburetor and super-heater, a cone bottom wash box, a three way valve with quick opening door, a cast iron backrun pipe, and a UGI automatic control, together with the necessary oil pumps and heaters required for heavy oil. The set was arranged to operate with the UGI waste heat boiler connected with the old nine foot set.

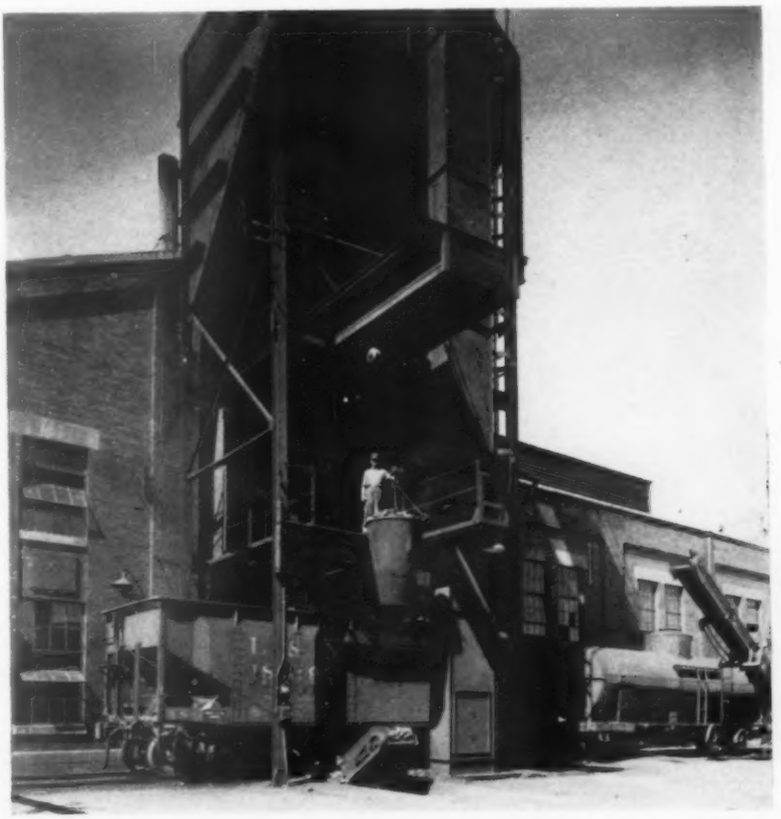
Generator Fuel Handling System

No water gas set can operate efficiently on 100% bituminous coal unless it is supplied with a uniformly sized fuel, free from fines. Because it is expensive to screen out the fines and burn them in a steam boiler (generally at a loss of two or three dollars per ton against competitive boiler fuel) breakage in a generator fuel handling system should be reduced to a minimum.

Our coal handling system is very simple. A battleship gondola type railroad car is spotted near the water gas room, over a Barber Greene car unloading conveyor until its contents are consumed by the water gas set. Approximately three to four days are required to consume one car of coal, but it is cheaper to pay $2.40 per day demurrage after the first two "free days" than to unload the coal either into storage pile or overhead bunker. Normally we pay no demurrage because credits obtained from prompt unloading of our fuel oil and boiler fuel more than balance the debits accruing from generator fuel cars. The gas maker, by pressing a button from the operating floor platform, fills his empty fuel bucket, elevates it to the operating floor platform, and conveys it to the water gas generator by means of a traveling electric hoist operating on a 12″ overhead monorail. A switch is provided so that the operator can charge fuel to either nine foot machine, and each bucket of coal is weighed by a monorail scales.

Cone Type Grates

Much has been written on the use of bituminous coal for generator fuel. We have been using 100% soft coal



Coal handling equipment at Beloit Gas Plant showing how coal is unloaded directly from railroad car to water gas set by way of bucket and overhead monorail system. Old overhead bunker is not used because it breaks 20% of the coal into boiler fuel which is worth about $2.00 per ton less.

*Part of Paper Presented at the Mid-West Gas Assn. School and Conference, Iowa State College, Ames, Ia., Sept. 1941.

in our generators since the shortage of coke during the first world's war created the necessity for our using a cheaper fuel. However, it is only within the past three years that we have found a satisfactory answer to the question of how to produce a uniformly hot fuel bed using 100% bituminous coal in a nine foot (or larger) water gas generator.

When using 100% bituminous coal for generator fuel, the center of the fuel bed offers most resistance to the passage of air and steam which therefore tends to pass up the areas nearest the sidewalls. The area of activity in the fuel bed extends approximately 18-24 inches from the generator walls with a decreasing temperature gradient toward the center of the fire where, in seven foot generators (and larger) we find an inactive uncarbonized column of coal which is useless for gasmaking purposes. In the past many operators have used the pier process which introduced a circular firebrick pier in the center of the fuel bed, thus coring out this inactive zone and creating a more uniform generator fuel bed. This process had disadvantages, however, in that it reduced the grate area and also made proper fuel spreading difficult because it is impossible to bank the freshly charged fuel both against the outer generator walls and the walls of the pier in the same operation. Thus although this process overcame the "dead center" in the generator fuel bed, it did not overcome the intensely active area next to the firebrick walls. A uniformly active generator fuel bed can be produced without the use of a pier in the following manner: (See drawing showing cone type grates.)

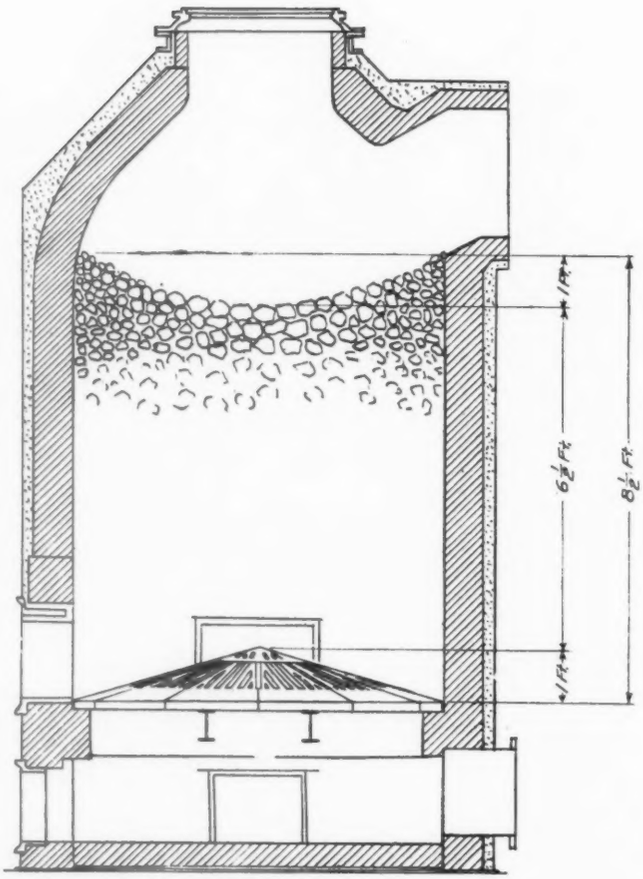
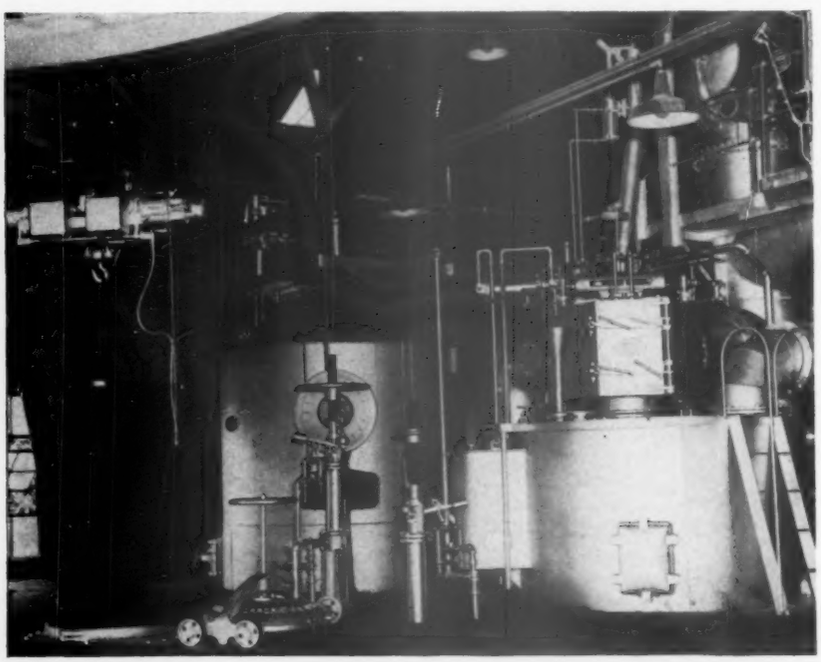


FIGURE 1

1. By reducing the depth of the center of the fuel bed to make it easy for the air and steam to pass through that area. This was accomplished by use of a cone type grate which is merely a standard grate that slopes upward until it is approximately one foot higher at the center of the generator than at the sidewalls.

2. By increasing the depth of the fuel bed next to the generator sidewalls, thus reducing the tendency of the air and steam to flow through this area. This was accomplished by using a fuel charging bucket with a cone bottom which acted as a fuel spreader, throwing the fuel to the sidewalls, thus building them up approximately one foot higher than the center of the fuel bed. We have obtained most uniform fuel spreading by having our gas-maker disengage hoist hook* "A", release lever "B", allowing cone spreader to drop sud-



Photograph shows 9' Semet Solvay Reverse Flow Water Gas Set installed by the Wisconsin Power and Light Co. in their Gas Plant, Beloit, Wisconsin.

*See diagram showing fuel charging bucket.

denly into proper fuel spreading position before the coal had an opportunity to leave the bucket. The coal is thrown from the spreader with such velocity that any soft spots at the generator sidewalls are packed down by the impact of the green fuel on the hot fuel bed.

As a result of these two factors, we have a generator fuel bed which is approximately two feet deeper at the generator sidewalls than at the center of the fuel bed. This two foot differential compensates for the tendency of the air and steam to flow up the generator sidewalls. The differential remains constant but becomes a greater percentage of the total fuel bed depth as the fire is lowered. Thus, by carrying a low fire it is possible to impart additional heat to the center of the generator fuel bed, or by carrying a higher fire it is possible to impart additional heat to the outer section of the fuel bed. In between these two points, at a position controlled by our fuel spreading, is a fuel bed depth at which we have a generator fuel bed free from blow holes, and of uniform temperature throughout the entire cross-section. We believe this is the answer to the use of 100% bituminous coal in large water gas generators.

Self-Cleaning Wash Box

Our Reverse Flow Water Gas Set is equipped with a cone bottom wash box which is self-cleaning. The overflow is taken from the bottom of the cone, thus continuously removing the heavy tars which settle to the bottom of the box. The overflow is built inside the cone to keep it warm.

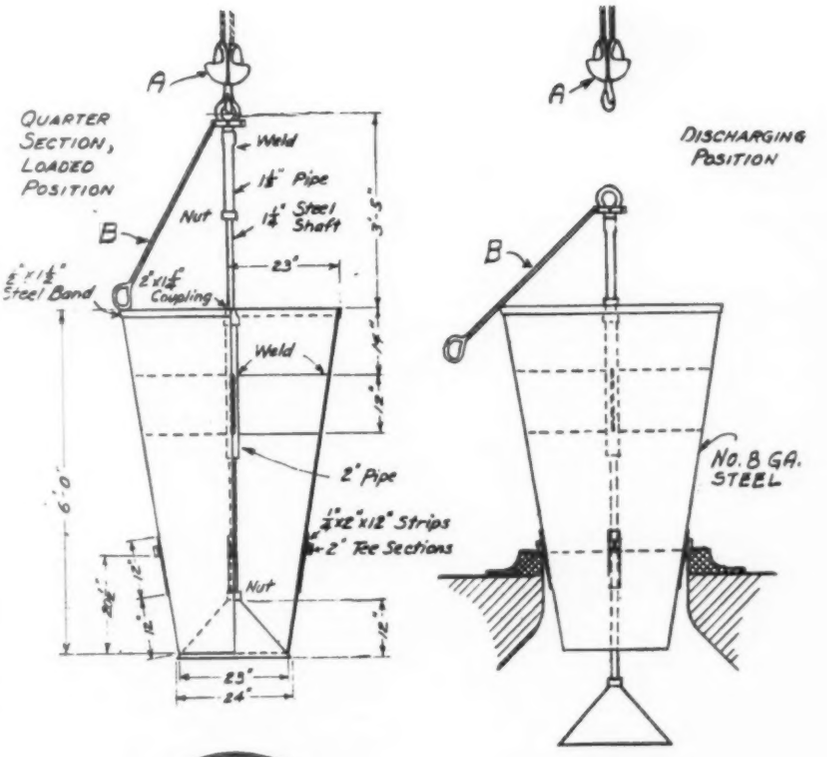
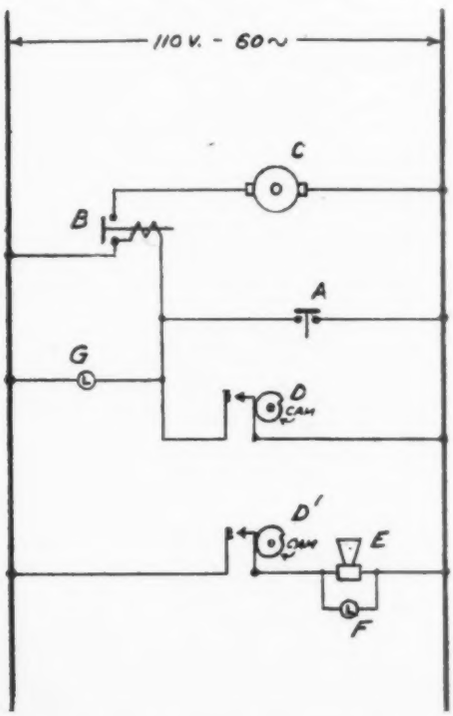


FIGURE 2

TOP VIEW



A - MICROSWITCH TYPE WZV-RN NORMALLY CLOSED MICROSWITCH CORP. FREEPORT, ILL.

B - SQUARE-D CONTACTOR CLASS 8511, 110V-15A-60~ SQUARE-D CO., MILWAUKEE

C - UG1 - AUTOMATIC CONTROL MOTOR, SINGLE PHASE 110V-60~ SYNCHRONOUS

D - CAM OPERATED SWITCH ON LEEDS & NORTHRUP MICROMAX ROUND CHART TYPE TEMPERATURE RECORDER

E - BENJAMIN INDUSTRIAL SIGNAL 110V.-2A.-60~ BENJAMIN ELECTRIC CO.

F - RED INDICATING LAMP GENERAL ELECTRIC CO. TYPE ET-2

G - WHITE INDICATING LAMP GENERAL ELECTRIC CO. TYPE ET-2

FIGURE 3

Automatic Control of Oil Cracking Temperatures*

Especially when using 100% bituminous coal for generator fuel, the carburetor and superheater temperatures in a water gas set will tend to fluctuate above and below the proper range for most efficient gasification of the oil, in spite of the accuracy with which the automatic cycle control is set. Fluctuation is due to such factors as condition of the generator fuel bed, the number of runs since last fuel charge, and the amount of oil per run. To maintain proper oil cracking temperatures requires the constant attention of the gas maker. Generally, proper temperatures are maintained by setting the automatic control as closely as possible, then instructing the gas maker to shorten the next blow if oil cracking temperatures exceed a given maximum, or to lengthen the next blow if oil cracking temperatures dip below a desired minimum.

To free the gas maker of the necessity of checking oil cracking temperatures each run, and to make it possible for him to do other duties in the vicinity of the water gas set, we developed the "automatic holdout"

** See wiring diagram of "automatic holdout."*

which automatically controls the oil cracking temperatures. Referring to Figure No. 3, the operation is as follows:

Temperatures are measured by means of an iron-constantan thermocouple installed ⅓ the distance from the top of the superheater and connected to a Leeds-Northrup potentiometer system round chart temperature recorder located on the gas maker's gaugeboard.

The automatic control is set in such a manner that proper oil cracking temperatures are not quite reached at the end of the normal blow period. Just before the end of this period, a cam on the automatic control opens micro-switch contact "A", thus de-energizing solenoid "B", and stopping automatic control motor "C". The blow will continue until desired oil cracking temperatures have been reached, when signal light cam on Micromax temperature recorder "D" will close signal light switch thus re-energizing solenoid "B", starting automatic control motor "C" and continuing the cycle. The white indicating lamp is used in setting the desired oil cracking temperatures, and will also inform the gas maker from a distance, that desired oil cracking temperatures are being maintained. As a protection against excessively high oil cracking temperatures, or against indefinite continuation of the blasting period through failure of the automatic control motor to start when signal light switch "D" is closed, a second signal light cam "D" is set to close a signal light switch and sound warning signal "E" if temperatures exceed a desired maximum or drop below a desired minimum.

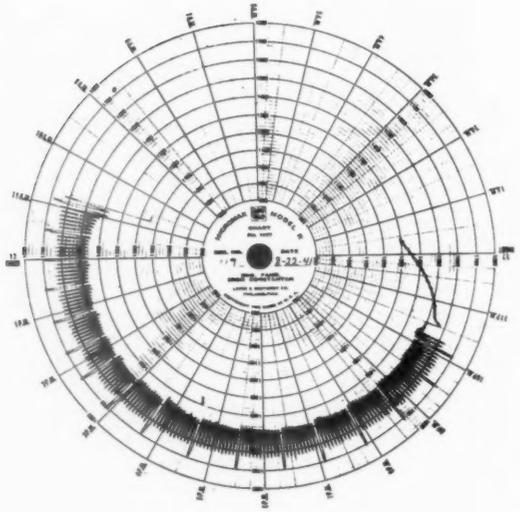
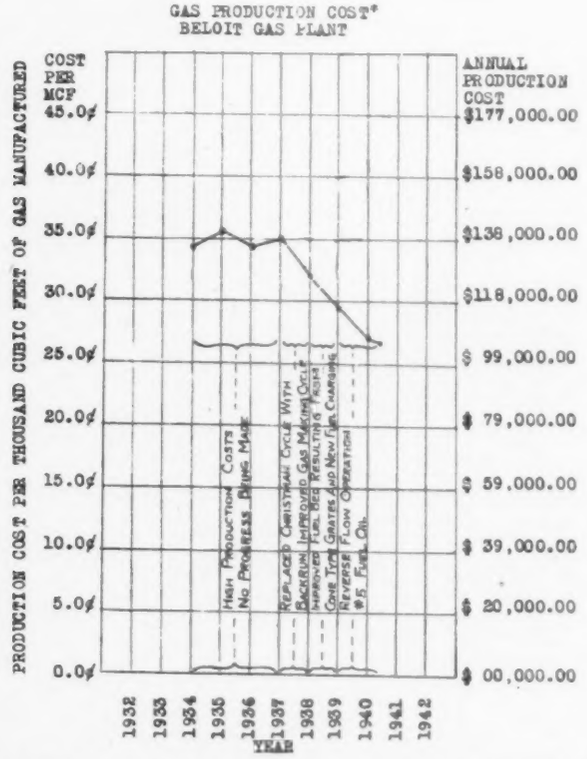


FIGURE 4

Figure No. 4 shows a typical day's temperature chart when using the automatic holdout. Fuel is charged after the blow. We call your attention to the fact that the blow before fuel charge is continued approximately sixty degrees beyond normal to compensate for the drop in temperature while fuel is being charged. This shortens the first two blows after fuel charge and allows us to set our carburetor air for the average blow rather than for the longest blow (worst smoke condition) which normally occurs the first two runs after fuel charge. We are able to produce smokeless operation with less carburetor air, thus increasing our combustion efficiency.

After the day's run has been completed the chart shows the period where the dust catcher door was opened to burn off the accumulated carbon. We find it desirable to burn off the carbon every third day. The heat generated by combustion of the carbon is absorbed as the gases pass through the waste heat boiler.

Our simplified coal handling syster, our automatic cycle control and our automatic control of oil cracking temperatures have permitted us to dispense with the services of a "gas makers helper." Our gas maker merely has to charge fuel every 30-40 minutes, check the heating value of the gas and the amount of oil per run at each fuel charge, and go about his miscellaneous duties in the vicinity of the water gas set.



*Gas production cost includes all generator fuel, fuel oil, boiler fuel, water, electricity and labor (including supervision) used for gas production and storage (including holder heating).

FIGURE 5

Our Four Minute Cycle

Blow	30.0%
Blow-run	5.0%
Up-run	30.0%
Back-run	33.0%
Final up-run	2.0%
Purge	0.0%
TOTAL	100.0%

Our four minute cycle is a compromise between a long cycle which has the advantage of less gas wasted to the atmosphere at the beginning and end of each blast (to avoid overpurging) and a short cycle which has the advantage of better steam decomposition and more uniform temperatures.

Carburetor air is opened with the generator air. Blue gas from the final up-run is just passing into the carburetor and provides a rich mixture for prompt ignition of the generator gases and carburetor air.

Both the up-run and back-run steam are set at 90 pounds per minute.

Oil is atomized with an Anthony Nebulyte oil spray having a five spud nozzle and designed to deliver twenty-five gallons per minute at 200 pounds per square inch pressure. Only five seconds after the oil vapors are sprayed into the carburetor, they are passing out through the wash box. Thus, any factor which assists in faster vaporization of the oil will increase the oil efficiency and also the stability of the gas. Oil admission begins approximately five seconds after the up-run begins, thus allowing all oil cracking to take place in an atmosphere of blue gas. Fifteen seconds time is required to clear the set of oil gas after the oil admission period. When using 100% bituminous coal, the set must be cleared of oil vapors before the back-run begins, otherwise trouble will be experienced with the generator fire.

A purge is unnecessary at the end of our cycle because a short final up-run is used. The purpose of the final up-run is to put a blanket of steam between the blue gas in the base of the generator and the air which follows. This can be accomplished in three to five seconds, leaving the carburetor and superheater still full of back-run steam which can be exhausted to the atmosphere with no loss of valuable gases.

Operating Difficulties Encountered

1. Trouble was experienced with blow holes in the center of the generator fuel bed until a single center cap was substituted for the double center cap in the center of the cone type grates.

2. Trouble was experienced with the brick work in the generator, carburetor and superheater domes. Cracks appeared in the generator neck and dome when the machine was first started up by the Semet-Solvay operator. The machine was

Operating Results with Reverse Flow Water Gas Set—Beloit, Wisconsin

	6 MO. PERIOD April 1, 1940 to Sept. 31, 1940	6 MO. PERIOD October 1, 1940 to March 31, 1941	3 MO. PERIOD May 1, 1941 to July 31, 1941
1. Period			
2. Gas Manufactured, Cu. Ft.	194,344,000	196,098,000	99,024,000
3. Make per Hour, Cu. Ft.	87,000	94,000	98,000
4. Kind of Fuel	100% 5"x3" Fleming Elkhorn Coal	100% 5"x3" Fleming Elkhorn Coal	100% 5"x3" Fleming Elkhorn Coal
5. Fuel Cost per Ton	$6.57	$6.77	$6.99
6. Kind of Oil	Michigan Fuel Oil	Illinois Fuel Oil	Nebraska Crude Oil
7. All Gravity of Oil	18/22 Gravity	18/22 Gravity	30/32 Gravity
8. Conradson Carbon, %	4 to 6 percent	4 to 6 percent	4 to 6 percent
9. Oil Cost per Gallon	3.06 cents/gallon	3.23 cents/gallon	4.29 cents/gallon
10. Oil per MCF	3.05 gal/MCF	2.99 gal/MCF	2.66 gal/MCF
11. Coal per MCF	23.7 lb/MCF	24.7 lb/MCF	24.7 lb/MCF
12. Tar per MCF	.92 gal/MCF	.90 gal/MCF	.51 gal/MCF
13. Tar Credit, c/gallon	2.625c/gallon	2.625c/gallon	2.625c/gallon
14. F.O.T.	14.7 cents/MCF	15.7 cents/MCF	18.6 cents/MCF
15. BTU.	520.	520.	520.

Five Possible Methods of Operating a Water Gas Set in Beloit, Wisconsin

1. Using 100% coke and gas oil			*520 BTU gas*
Egg coke	28.1 lb./MCF	@ $9.00/ton	12.65c/MCF
Michigan gas oil	2.42 gal./MCF	@ 5.97/gal.	14.45c/MCF
Total			27.10c/MCF
15% tar recovery	.36 gal./MCF	@ 4.0c/gal.	1.44c/MCF
F. O. T.			25.66c/MCF

These figures are based on present cost of coke and gas oil delivered in Beloit, Wisconsin, and on present market for water gas tar made from gas oil. Fuel results are based on operation at plan "X" in the state of Wisconsin, using a standard water gas set.

2. Using 100% coke and #6 fuel oil			*520 BTU gas*
Egg coke	13.8 lb./MCF	@ $9.00/ton	6.21c/MCF
#6 fuel oil	4.70 gal./MCF	@ 4.60/gal.	21.59c/MCF
Total			27.80c/MCF
27.9% tar recovery	1.31 gal./MCF	@ 2.625c/MCF	3.44c/MCF
F. O. T.			24.36c/MCF

These figures are based on present cost of coke and #6 fuel oil delivered in Beloit, Wisconsin, and on present price we are receiving for our water gas tar. Fuel results are based on those obtained at Portland, Maine (See AMERICAN GAS JOURNAL for June, 1941, "Two Years' Experience with Reversed Flow Machines at Portland, Maine," by George R. Steere). Results originally for 535 BTU gas, were multiplied by 520/535 to reduce them to a comparable 520 BTU basis.

3. Using 100% bituminous coal and gas oil			*520 BTU gas*
100% Fleming Elkhorn coal	25.4 lb./MCF	@ $7.18/ton	9.12c/MCF
Illinois gas oil	2.67 gal./MCF	@ 5.26c/gal.	14.05c/MCF
Total			23.17c/MCF
18% tar recovery	.48 gal/MCF	@ 4.0c/gal.	1.92c/MCF
F. O. T.			21.25c/MCF

These figures are based on present cost of coal and gas oil delivered in Beloit, Wisconsin, and on present market for water gas tar made from gas oil. Fuel results are those obtained by the Beloit gas plant for the year 1939, using a standard nine foot automatic control set.

4. Using 100% bituminous coal and #5 fuel oil			*520 BTU gas*
100% Fleming Elkhorn coal	24.7 lb./MCF	@ $7.18/ton	8.87c/MCF
#5 fuel oil	2.99 gal./MCF	@ 4.79c/gal.	14.32c/MCF
Total			23.19c/MCF
30% tar recovery	.90 gal./MCF	@ 2.625c/gal.	2.36c/MCF
F. O. T.			20.83c/MCF

These figures are based on present cost of coal and #5 fuel oil delivered in Beloit, Wisconsin, and on present price we are receiving for our water gas tar. Fuel results are those obtained by the Beloit gas plant for the six month period from August 1st, 1940, to January 31st, 1941.

5. Using 100% bituminous coal and Nebraska crude oil			*520 BTU gas*
100% Fleming Elkhorn coal	24.7 lb./MCF	@ $7.18/ton	8.87c/MCF
Nebraska fuel oil	2.66 gal./MCF	@ 4.79c/gal.	12.74c/MCF
Total			21.61c/MCF
18% tar recovery	.48 gal./MCF	@ 2.625c/gal.	1.26c/MCF
F. O. T.			20.35c/MCF

These figures are based on present cost of coal and Nebraska fuel oil delivered in Beloit, Wisconsin, and on present price we are receiving for our water gas tar. Fuel results are those obtained by the Beloit gas plant from May 1, 1941 to August 1, 1941.

immediately shut down to repair these cracks, and upon inspection other cracks were discovered in the carburetor and superheater domes. These cracks were successfully repaired by Semet-Solvay.

3. Trouble was experienced with excessive melting of the firebrick arches over the clinker doors. The doors became extremely hot and frequent packing was necessary to keep them from leaking. This difficulty was remedied by cutting a slot through the bottom door liner to the ash pit, thus allowing up-run steam and air to cool the doors and arches. The door liners were re-designed so they did not project so far into the fire. The firebrick arches were replaced with Plibrico jointless firebrick (which we have been using for clinker door arches for several years). No further trouble has been experienced and present clinker door arches are in excellent condition after 5,000 hours operation.

4. Trouble was experienced with the generator fuel bed when we attempted to reform approximately 15% of our oil by spraying it into the carburetor during the back-run. Distribution of the oil on the generator fuel bed was not uniform, most of the oil carbon depositing on the side of the generator fuel bed nearest the carburetor. A crust was formed on the top of the fuel bed which burned out underneath. Blow holes finally developed and upon barring the fire, the crust caved in and dropped about two feet revealing the true level of the fuel bed. Reforming was abandoned because of the damaging effect of the blow holes on the generator lining. However, we have no doubt but what we could successfully reform using 100% coke or even a mixture of coal and coke.

5. Trouble was experienced with tar in the recirculating liquor system which cools the three-way valve when the temperature of the tar separator was allowed to drop below 170 degrees Fahrenheit. Carbon particles in the tar would clog the screen of our 2½" Elliott type "V" twin strainer (we now prefer a Cuno self-cleaning strainer) preventing the recirculating liquor from reaching the three-way valve and wash box. This trouble was traced to the oil spray and waste heat boiler positive cut-off blank cooling water which emptied into the seal pot and flowed from there into the separator. Because we have a relatively hard water we were unable to increase the temperature of this water without lime precipitation. This problem was solved by running the oil spray water and the positive cut-off blank water to the sewer.

6. Trouble was experienced in pumping the heavy tars which accumulated in our relief holder inlet and outlet drips. A close clearance tar pump, a short suction line with few bends, and a means of heating the heavy material in the drip is the answer to this problem.

7. Trouble was experienced with oil vapors passing through the water gas set without being completely cracked into permanent gases. The trowel test was satisfactory and heats could not be raised further without producing naphthalene. This difficulty was eliminated by changing the superheater checkerbrick spacing from 4" flued formation to 2" staggered formation.

Operating Difficulties Which Did Not Develop

1. We experienced no difficulty in operating with crude oil, heavy oil and gas oil.
2. We experienced no difficulty from carbon deposits in the water gas set.
3. No difficulty was experienced in heating and pumping the heavy oil in the coldest winter months.
4. No difficulty was experienced in cleaning the three-way valve.
5. No difficulty was experienced with the self cleaning wash box. It has never refused to overflow and has never required cleaning.
6. We experienced no difficulty in producing smokeless operation.
7. We experienced no difficulty in dehydrating our heavy oil tar. All tar emulsions are dumped into the relief holder where heavy oil emulsions will separate to a 10% moisture content. Moisture content is further reduced to below 5% by heating in our storage tanks.

If We Were to Build Another Water Gas Set

1. We would line the generator with carborundum brick 4' from the grates. The generator lining is the one weak spot which prevents this machine from operating for an indefinite period.
2. We would construct the operating floor of checkered steel plate. This type of floor is not excessively warm if thin steel plate is used. It is much easier to keep clean and retains its appearance much longer than a brick floor.
3. We would place an expansion tank in oil line between meter and hydraulic control valve to absorb shock from sudden closing of valve.

New Customers Service Order System and Gas Air Conditioning Equipment Are Features of New Office Building Annex of Southern California Gas Company

By
Fred A. Herr
Los Angeles, California

THE Southern California Gas Co. opened its new office building annex, costing in excess of $450,000, at 820 South Flower Street, Los Angeles, in September. The five-story, mezzanine and basement structure adjoins the height-limit office building occupied jointly by the Southern California Gas Co. and the Southern Counties Gas Co.

The new building is of reinforced concrete construction and is designed to sustain two additional stories. It embodies structural features and innovations in merchandising, operations and administrative technique and equipment which make it rank among the most modern utility buildings in the country.

Among the building's notable features are:

(a) The largest installation of gas air conditioning machinery on the Pacific Coast.

(b) Arrangement of the gas air conditioning equipment to serve as display units, with machinery and piping installed to facilitate demonstration to prospective customers of commercial air conditioning.

(c) Improvements in the Telephone Service Bureau conveyor method of receiving and dispatching customer service orders that represent important advances in this phase of operations in the gas utility field.

Telephone Service Bureau

When erection of the new building was considered the Southern California Gas Co. decided to replace the central station turret board order receiving system, then being used, with a modern Telephone Service Bureau. The company was determined to install in the new building a telephone order receiving and dispatching system that would not only embody the best features of systems already in use by gas companies elsewhere in the United States, but would go beyond the limits of existing practice by incorporating improvements originated by its own technicians.

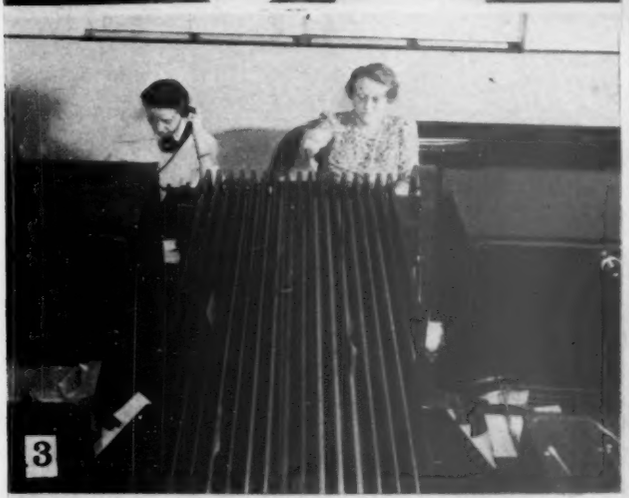
As a means of determining the exact requirements of the Southern California Gas Co., a series of surveys was made covering a period of some 18 months. These surveys included an analysis of customer telephone load characteristics, of the demands which customers make in the way of service on new appliance installations and the adjustment of installed appliances, and of the equipment used by other large companies which have done some pioneering in the use of specialized telephone equipment to meet the demands in the utility field of customer service. Case histories were studied from the Customers Department files, conversations of customers requesting service were monitored, and several trips were made through the East to visit other utilities which had developed up-to-date service departments and had installed some of the more modern types of equipment.

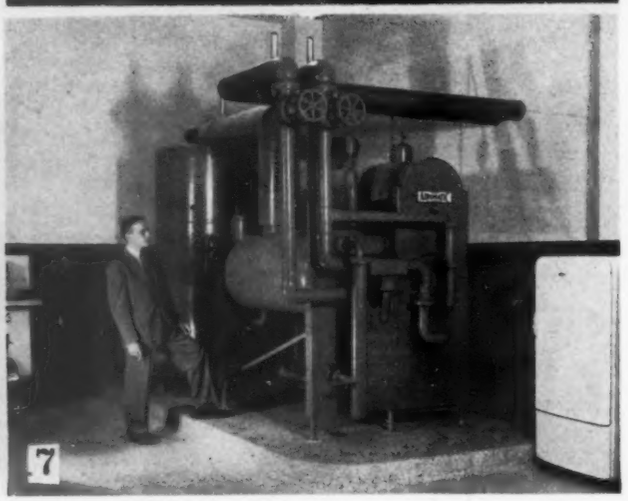
The results of the various studies have been incorporated into what is regarded as the most advanced order receiving and dispatching system in use by any gas company in the country.

The Southern California Gas Co.'s new Customer Service Bureau has been installed on the second floor of the new building in a room 40 x 80 feet in dimension, in which 40 telephone positions are provided for receiving customer calls for service or information regarding accounts. The installation was made with provision for expansion to an ultimate of 60 positions. The telephones used by the 40 telephone clerks are installed on individual desks in double rows. Between each two rows of desks a belt conveyor is provided to carry the orders received from customers to a master conveyor belt along the south side of the room, which in turn delivers the orders to a central sorting desk.

Southern California Gas Co.'s new $450,000 office building in Los Angeles, which was dedicated in September. It adjoins the 11-story main office building, a corner of which is seen on the left.

At these 40 positions calls are received direct from customers without any intermediate connection through the P.B.X. board, by means of a special listing placed in the telephone directory whereby the first number listed under Southern California Gas Co. gives the number which will take the call directly to the Customer Service Bureau. No bells or buzzers are used on the telephones. The new type instruments are designed so that, when a red light flashes and the





(1) Shows the conveyor system for expediting telephone orders in the Telephone Service Bureau. Four conveyor lines of the type shown here serve 40 telephone positions.

(2) Orders from the 40 telephone clerks are brought to this central sorting desk by the master conveyor on left. They are then placed on another conveyor (right-center) for delivery to file clerks for checking.

(3) Upper view of sorter conveyor, shows varying length of conveyor lines and the chute system (foreground, left-right) which diverts the orders to the respective file positions.

(4) General view of Order Checking Department. The sorter conveyor drops orders into a basket between each of the files. Orders are distributed by street name. One file clerk, for instance, checks all orders for streets beginning with letters AA-AO.

Note opening beneath conveyor line in lower-right corner. Checked orders are dropped through the opening onto another conveyor which passes through the wall into the Order Dispatching Department.

(5) Showing the sorter's desk in Order Dispatching Department. Conveyor (left) brings orders from the Telephone Service Bureau. Orders for immediate execution are distributed by sorter (foreground) to eight dispatchers by means of conveyor (right). Orders for future completion are evaluated by order assembler as to time required for completion and filed by "date to be completed".

(6) The Dispatching Room, showing the conveyor line which serves eight order dispatchers.

(7) The new building has the largest gas air conditioning system on the Pacific Coast. A clever feature is the manner in which the installation is "sales slanted" so as to serve as demonstration model in selling to the industrial trade. Shown here is one of the four 40-ton Williams Air-O-Matic refrigeration units. It is installed on the sales floor of the Merchandising Section, fully visible to all visitors.

telephone clerk receives a call, the customer's voice can be heard distinctly.

As the requests for service are received by the telephone clerks, the proper order forms are filled out, dropped on the conveyor and carried to the terminal for sorting. Orders of selected types are sent by other conveyors to the customer record files in which previous orders for appliance service or the turning off or on of meters are filed by street names. This set of conveyors delivers the orders to the proper file where a file clerk compares the new order with previous orders and records any pertinent information concerning credit, current duplicate orders, previous orders, or location index. After these orders have been checked, they are carried on a return conveyor to the dispatching department, from which they are telephoned or mailed to the field men for execution.

One of the most important developments of the new installation at the Southern California Gas Co. is the direct receipt of customer request calls by the telephone order clerks and the three-way telephone conversations which may be carried on with the customer, the telephone order clerk, and a credit or bookkeeping clerk in another department. The customer-request calls for service or information are screened to the Customer Service Bureau by means of a particular type of listing in the Los Angeles telephone directory. In case the customer is requesting information regarding the amount, date of payment, or credit extension relating to a bill, the telephone order clerk can hold the customer on the line and call the proper clerk in the department concerned. This arrangement makes it possible for a three-way conversation to be carried on between the customer, the bookkeeping department and the order receiving clerk, with the latter listening in and finally disposing of the customer's request with the proper closing salutation after the desired information has been obtained.

This type of installation, officials of the company point out, eliminates the previous necessity for the customer to repeat the request first to the P.B.X. operator in the central station, then to the order receiving clerk, and then to a third clerk in the particular department concerned. The former method of contact often resulted in the necessity for the customer to transfer to a different number and, in some cases, to hang up in irritation.

The installation in the office of the supervisor of the Customer Service Bureau provides an effective control of the assignment of telephone order clerks throughout the day and of the utilization of the clerks working at the various positions. The supervisor's cabinet contains a lamp for each operator, each trunk line and each storage unit where calls are held in the event all the telephone positions are momentarily busy. The equipment automatically stores the calls until a conversation within that unit is closed, when the waiting call immediately goes to the idle station. By assigning the telephone order clerks to the proper stations, the supervisor can keep the traffic load in balance and distribute it equally among the operators.

A complete monitor system is also provided whereby the supervisor can listen to any of the conversations between the customer and the clerk and train the clerks in the desired handling of customer contacts. The device is used in directing the nature of public contact and in training operators effectively to handle the various types of requests.

A third calibrating cabinet is provided where each line is metered and the number of calls received is recorded. This cabinet also shows how long customers have waited before the conversation with the operator began. Sample conversations may be recorded by stenotype or other devices and the transcripts used for improving the technique and for training applicants for Customer Service Bureau Work. Approximately 15% of the conversations of each operator is stenotyped by the Southern California Gas Co.

Typical Conversations Recorded

As a means of improving the technique of the telephone order clerks, transcripts of actual conversations used by the better operators have been accumulated and catalogued so that a new operator may read through the catalogue and find typical examples of the proper method of discussing with the customer such requests as "Turn-off gas," "Adjust Appliances," "My bill is too high," "Where is my meter located?", and the like. The catalogue contains 95 types of sample conversations.

The Southern California Gas Co. employs girls exclusively in the Customer Service Bureau. The qualifications are high. College graduates are given preference. Applicants are tested for voice, aptitude and mental ability. The training of a new operator is carried out in three stages—actual information, technical and mechanical instructions and voice culture, and a finishing and polishing course in which the finer techniques are developed. All instruction is done by actual work on the job.

The Telephone Service Bureau handles as high as 7500 calls per day in the spring, fall and winter, and about 3,000 per day in summer. The average operator handles from 14 to 18 calls per hour in an eight-hour day. The Bureau's busiest day is Monday, when calls run 23% above the average week day. The busiest time of day is between 9:00 A.M. and 11:30 A.M.; the lightest, from 4:00 to 5:00 P.M. The busiest day of the month is the first business day, when calls run 17% above normal.

A number of improvements in order executing technique have been originated by the Southern California Gas Co. for use in its Order Dispatching Department. This department is located on the same floor and adjacent to the Telephone Service Bureau and, therefore, enjoys a unique advantage over most dispatching systems. The proximity and the resultant close co-operation eliminates the need for teletype systems, telephone calls and messenger runs.

Three-way conversation telephones are also used in the dispatching department. Each of the eight dispatch positions is equipped with two-way jacks which permit plugging in of another headpiece—an important feature for personnel training purposes. A monitor system permits listening in on conversations between the dispatchers and field men.

The Dispatch Office

Orders from the Telephone Service Bureau arrive at the dispatch office sorting desk by conveyor. The orders are assembled according to date of completion promised, and those which are for execution on the same day are sent to an order dispatcher by another conveyor belt for dispatching by telephone. Orders for execution on subsequent days are filed by date to be completed and "made up" into days of work the night before they are to be executed. The orders are dispatched according to a schedule which gives the average time evaluation for the execution of the order in the field. Although the time required to execute any individual order of a given type may vary quite widely, the average time evaluation allows the dispatching office to give each field man a reasonable day's assignment of work and, at the same time, permits the order executing department to control the use of its man-power so that it will correlate with the volume of orders received and the dates on which execution may be promised.

Receiving and Dispatching of Orders is Separated

The installation of the new type telephone equipment at the Southern California Gas Co. has been accompanied by definitie separation of the services of receiving orders and dispatching orders. Previously these two services were handled by the same group. Now the Customer Service Bureau is set up as a separate department for the purpose of receiving the orders from customers over the telephone and securing all information necessary for the proper execution of the orders. The Operating Department, called the Customer Service Department, is concerned only with the problem of executing the orders as received by the Customer Service Bureau on the date on which the order has been promised.

In the past, the company had experienced some difficulty in establishing the definite responsibility for the failure to provide the service requested by customers at the time wanted.

Under the present plan, the operating department is committed to the promises given the customer by the order receiving department. The latter department, within the limits of the schedule of the operating department, is free to have its order receiving girls inform the customer on which day and at which hour an order will be executed. Orders are accepted for execution according to a definite schedule provided by the operating department, under which each type of order may be promised for execution in a given number of days, in keeping with the man-power available for executing orders and the possible balance of crews. This execution schedule provides the pattern according to which orders are normally received, but the pattern may be varied by an agreement between the two department heads in order to balance the man-power available and the customer demand load.

If the number of in-coming orders is small, the Customer Service Bureau may be requested to accept a larger than normal proportion of the orders for today's execution; whereas, if the customer load is very heavy, the telephone order clerks may be required to attempt to get customers to accept execution several days hence, except in urgent cases. This balance is watched closely and is varied for different days of the week and even for hours of the day.

Prepared _____ DAILY OPERATING REPORT D-126 RMO'H h Rev. 9-29-41

REPORT (SECTION ONE) FOR _____ SCHEDULE _____

	S-1	S-2
Normal No. Men Working		
Plus No. Called Out. .		
Less No. Off Sick. . .		
TOTAL NO. WORKING. . .		

Assigned to:

	S-1	S-2
Customer Service Routes (Days)		
Disp. Off. Est. of Route Reqs.		
Periodic Meter Changes		
4 p.m. to 12 m. Shift.		
12 m. to 8 a.m. Shift.		
Restaurants.		
Apartment House Crews.		
School Surveys		
Locks and Dial Glasses		
Trace and Tag.		
Rule 20 Survey		
Specials (_____)		

WAC Pitched to Non-Phone Routes

S-1: _____ S-2: _____

Standards Department Forecast and Dispatch Office Estimate of Work Assignment Credits for _____

	To Be Rec'd	Tot. Rec'd for "Today"	To Be Executed
Stds.Dept.		Not F'cast	
Disp.Off.	Not Est.		
Actual	SEE	NEXT DAY'S	REPORT

(Actual and Dispatch Office Estimates include Company Orders; the Standards Department Forecast does not.)

ORDERS AND WAC MAILED TO ROUTES

	Los Angeles Orders	Los Angeles WAC	Pasadena Orders	Pasadena WAC	Total Orders	Total WAC
T.O.						
Clo.						
C.S.O.						
H.B.						
Insp.						
Misc.						
L.P.						
Orders						
WAC						

(For Div. Total, See Sec. II for above date)

ORDERS HELD IN

	Los Angeles Orders	Los Angeles WAC	Pasadena Orders	Pasadena WAC	Total Orders	Total WAC
Clo.						
CSO						
H.B.						
Insp						
D.G.						
T&T						
Misc						
Orders						
WAC						

REPORT (SECTION TWO) FOR _____

ORDERS AND WAC TELEPHONED TO ROUTES

	T.O.	Clo.	CSO	Misc	Total
Los Angeles:					
Orders					
WAC					
Pasadena:					
Orders					
WAC					
Total:					
Orders					
WAC					

DIVISION TOTAL, DISPATCHED:

Orders _____ WAC _____

ACTUAL WAC FOR _____

Total Received _____

Rec'd for "Today" _____

Total Executed _____

(Tot. Disp., less DNR WAC)

ORDERS UNCOMPLETED

	TO	Clo.	CSO	HB	Insp	PMC	Parts	Misc	Total
D.N.R.									
C.G.I.									
Duplicate									
Wr. Addr.									
Not Ready									
No O.K.									
GasOn-CNV									
Cancel									
Miscel.									
TOTAL									

"DID NOT REACH" ORDERS - SUMMARY

Total "Did Not Reach" Orders . . . . . _____

Total "Did Not Reach" Work Assignment Credits . . . . . _____

Per Cent of "Did Not Reach" Work Assignment Credits to Total Dispatched . . . _____

The Daily Operating Report is a mimeographed form—size 8½ x 11.

Report Forms

The Customer Service Department has developed several unusually effective report forms for recording the progress of executing orders, which enable the superintendent to keep in close touch with the field operations and the assignment of servicemen.

"ICE FROM HEAT?"
Who doesn't remember the amazing news that a freezing unit could be operated by a *flame?* Modern scientists and engineers got one of their great surprises when Von Platen and Munters, inventors of the gas refrigerator, demonstrated their new principle.

H. Harper-Wyman Co.

Nothing convinces like demonstration

MANY sales-managers agree that the gas industry needs constructive *showmanship* to prove the superiorities of gas to the public. And what "show" is so productive as a demonstration of the Harper Burner System?

Here is the finest cooking unit ever engineered. Harper's "2 burners in 1" combine a speedy STARTING BURNER with a small, independent COOKING BURNER...both controlled by the same handle. The COOKING BURNER continues the cooking with just the right amount of fuel —no waste. No other burner in the world can say as much!

Connect a Harper-equipped range to gas—and *demonstrate* it! Nothing else offers such conviction that "Gas does it best."

DEMONSTRATES THAT "GAS DOES IT BEST"

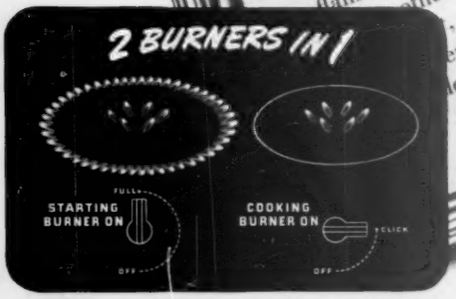
HARPER
BURNER SYSTEM

TURN THIS PAGE FOR PROOF THAT DEMONSTRATION PAYS...

This FREE *48-page handbook will help you sell more gas ranges...*

This handbook contains 12 tested, practical floor demonstrations to convince your customers that the modern gas range offers every possible advantage. Send for copies of "How to Sell More Gas Ranges." ***Harper-Wyman Company, 8562 Vincennes Avenue, Chicago.***

DEMONSTRATION NO. 5
IT PROVES:
The low "keep warm" heat of the Cooking Burner.
EQUIPMENT:
A candle. A candy thermometer.
STEP 1. Light an ordinary candle.
STEP 2. Turn on the Harper Cooking Burner and turn it down to its lowest flame . . . the "keep warm" heat.
STEP 3. Ask your customers to feel with their hands the comparative heats of the two—proving that the "keep-warm" heat is actually lower than that of the candle and couldn't possibly continue to cook foods placed over it to keep warm. Hold a thermometer first over the "keep warm" flame, then over the candle, making sure to hold it the *same distance* from each. This will give visual proof of the far lower heat of the "keep warm" flame.
Use these money-makers to put over your point
"This 'keep warm' heat is actually not as hot as a candle flame! It couldn't possibly over-cook your foods."
"The big advantage of this flame is this. You can start cooking all foods at the same time. Meals are bound to come out evenly. The foods finished first are simply placed over burners turned to this 'keep warm' flame until the other foods are cooked."
"You'll have no 'cold foods' with this burner . . . no over-cooked foods . . . no 'warmed-over' taste!"
"Harper Burners help banish that 'steam-table' sogginess."



The Harper Burner System operates on the unique principle of a burner within a burner, "2 burners in 1", both controlled by the same handle. The small* COOKING BURNER *operates independently of the* STARTING BURNER. *No other burner in the world offers this advantage.

"When the Harper Burner System was developed and made available on Detroit Jewel Gas Ranges, it gave us one of the most remarkable and convincing sales demonstrations we have ever used.

"We believe there is no substitute for demonstration to give customers a convincing picture of top burner cookery. Our salesmen realize the importance of proving their sales arguments, and the Harper Burner System gives them the visual proof they need to back up their story of the 'saving in time, fuel and food' on these modern Detroit Jewels."

(Signed) **V. C. Ericson**
Adam, Meldrum & Anderson Co.
Buffalo, N. Y.

Proof That Demonstration Pays

HARPER BURNER SYSTEM

—one of the standards of top burner performance under (hp)

One of these forms is the *Daily Operating Report,* which is a resume of each day's field operations. It condenses onto one 8½ x 11 inch sheet a complete picture of the operations during the current day and the anticipated load for the next day. It shows, among other things the normal number of men working, the number of extra men called out, the number of men off duty on account of illness, the number of men assigned to the work of completing "today" orders and the number working on orders which were received on previous days, the type and number of service orders completed in each district, the number and type of orders which were brought back uncompleted, and the number of "Can't Get In" orders.

The sheet also shows the total orders received for the day, the total dispatched, and the total executed, as well as the time evaluation in man-power of the amount of work dispatched versus the work brought back uncompleted. This report also contains a section showing the estimate of the next day's work, based on the record of orders already received and promised for the following day and on the forecast or orders to be received the next day for immediate execution.

The order sorting desk maintains a tally of the orders received for each future date, so that for any given day the man-power required to execute orders already received may be calculated. The additional work which will be received on the following day for execution on that particular day is obtained from a forecast made by the Standards Department, which develops from the historic patterns the amount of work which would normally be expected for the day in question.

Another report blank is the *daily Record of "Today" Orders to Be Executed.* This report supplements the Daily Operating Report and shows the total amount of work valuated in man-hours which can be executed by the men assigned to phone

DAILY RECORD OF TODAY ORDERS TO BE EXECUTED

DATE _____

TIME	TURN ON	C.S.O.	MISC.	Total Orders	Total Points	PASADENA		WILSHIRE		WEST		SO.CENTRAL		METRO.	
						TO	CSO	TO	CSO	TO	CSO	TO	CSO	TO	CSO
12:00 M. to 8:00 A.M.															
1:00															
2:00															
8															
12:00															
TOTAL															

SUMMARY OF ORDERS FOR COMPLETION TODAY

DISTRICT	Number Routes		Points Possible		REMARKS
	S-1	S-2	S-1	S-2	
Pasadena					
Wilshire					
West					
So. Central					
Metropolitan					
TOTAL					
Combined Total					

D-78 JC/p, revised 3/18/41

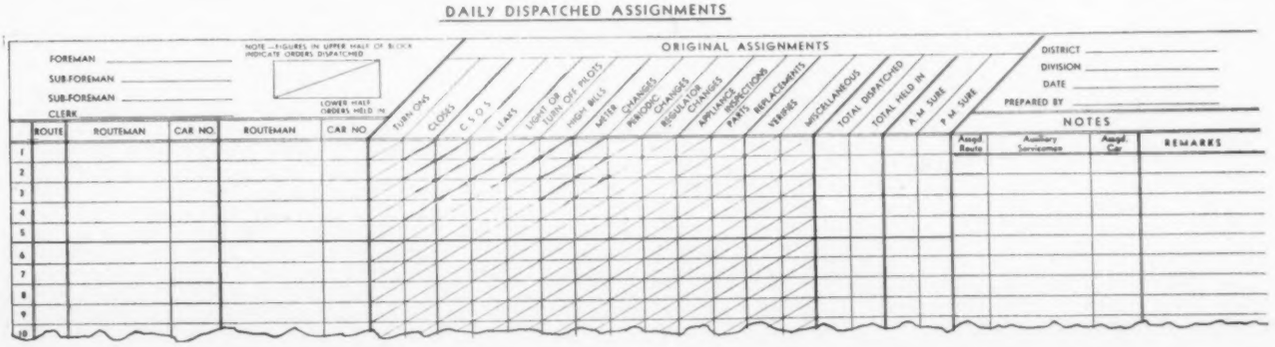
The Daily Record of Orders to be Executed is a mimeographed form—8½ x 12.

routes in the various districts. The report also records and evaluates the orders received for execution the same day. A cumulative total of the evaluations of these "today" orders is maintained. When this cumulative total approaches the figure which indicates the total work which can be executed by the phone routes, this indicates to the dispatch superintendent that a change must be made in the order receiving schedule or that more man-power must be provided. The course to be pursued is then determined on the merits of the particular case. For example, if more service-men are available, the man-power may be augmented. If this is not possible, another alternative is to change the order receiving schedule and tell customers that the orders will be executed on the next or some other future day. The day on which the order will be executed, however, is definitely indicated to the customer.

The *Dispatcher's Tally Sheet* is still another form originated by the Southern California Gas Co. It serves as a check-up on work to be executed by those field men who are not assigned to phone routes. The form lists the name and route of each field man in the district which the tally sheet covers. These field men are required to phone in to the dispatcher's office at set intervals to inquire if emergency orders are awaiting immediate execution. The dispatcher then evaluates the time of execution for orders on hand and decides whether to issue additional

The Daily Dispatched Assignments is a blank, printed on one side only in green ink on 17 x 19 inch heavy bookkeeping stock. It has a perforated margin for loose-leaf filing.

DAILY DISPATCHED ASSIGNMENTS



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YEAR 'ROUND COMFORT . . . summer cooling . . . winter heating . . . controlled humidity.

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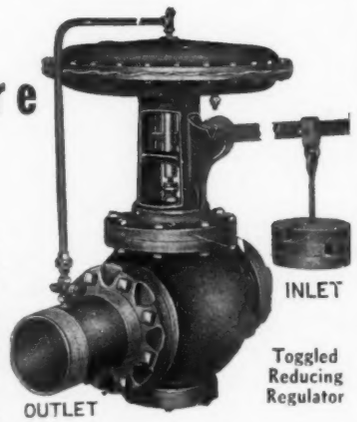
100 Pounds or More Cut to Medium or Low Pressure



PRESSURES of 50 to 100 pounds or more in tanks or transmission lines are reduced to medium or low pressure for distribution by the Fulton Toggled Reducing Regulator. Can be equipped for accurate control of natural gas, manufactured gas, or by-product gas. For reversing furnaces, constructed with oversize valves. Ask for Circular 2573, also Catalog of C-F Regulators for all requirements of pressure control.

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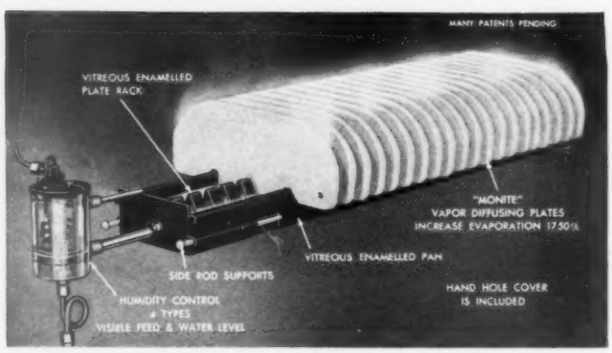
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orders to the man on the phone.

A fourth form recently developed by this company is headed *Daily Dispatched Assignments.* This form gives a direct summary record on a 17 x 19 inch sheet designed for loose-leaf filing, from which the district foreman may obtain a reasonably complete summary of the activity in his district on any day. In the past, the foreman often was handicapped by the lack of complete information as to the overall picture of the operations within his district. The record shows for each of the routes the name of the serviceman assigned to that route, the car number assigned, and the number of each type of order given him for execution. These orders are segregated into some thirteen different classifications and the report shows the total number of each type dispatched and the total number held in for lack of man-power.

A section of this report form also shows the number and names of men absent for various causes, such as sickness and "scheduled day off." The record provides the district foreman with a rather complete picture of his operations and gives much hitherto unavailable information in considerable detail.

DISPATCHER'S TALLY SHEET

METROPOLITAN DISTRICT EAST

Sheet No. 1

* Servicemen working on routes indicated by asterisk work from 10:00 to 6:30.

FORM: ORDERS TELEPHONED TO SERVICEMEN

NAME	Route No.	Orders Disp. at 8:30 a.m. F.O.	C&O	Misc.						
	80A				9:05	11:25	1:25	3:25		
	* 81A				10:35	12:35	2:35	4:15	5:15	
	82A				9:45	11:55	1:55	3:55		
	* 83A				11:05	1:05	3:05	4:25	5:25	
	84A				10:05	12:10	2:10	4:10		
	* 85A				10:50	12:50	2:50	4:20	5:20	
	86A				9:25	11:40	1:40	3:40		
					RESTAURANTS					
	1				6:00	9:00	11:35			
	2				10:00	12:05	2:05			
	3				10:25	12:25	2:25			
	4				10:40	12:40	2:40			
	5				11:10	1:10	3:10			

D-111 (Background) JC/h (9/2/41)
D-121 (Foreground) JC/h (9/4/41)

Date _____

The Dispatcher's Tally Sheet is a mimeographed form—size 8½ x 11.

Air Conditioning System

The Southern California Gas Co.'s new building is completely air conditioned by a system which uses gas fuel for heating and cooling. It is regarded as the largest gas air conditioning installation on the Pacific Coast.

Absorption type refrigeration equipment is used, which eliminates the need for compressors and makes it possible to utilize winter boiler heating capacity for summer air conditioning requirements. The equipment consists of four 40-ton Williams Air-O-Matic low-pressure absorption refrigeration units. Three units are installed in the basement of the main office building and one unit on the first floor of the new building, where it serves as a demonstration model in the Merchandise Section of the Sales Department.

Each cooling unit consists of a condenser, condenser water pump and heat exchanger. Each unit also has an individual cooling tower, the four towers being located on the roof of the annex.

Equipment for handling air on the various floors is installed in a machinery room at the rear of each floor. The water is circulated from a single 500-gallon cold water tank in the basement of the old building. Water is pumped from the tank into the chilling units and returned to the tank. Two pumps (one a stand-by unit) are available for lifting the water off the main line of the tank to the machinery room on each floor.

One master fan handles distribution of air on the different floors, expelling into ducts installed in furred spaces above the ceiling. Cooling coils are installed in the main duct on each floor. Air discharge in the rooms is through ceiling mounted Anemostats.

The new building is heated by three Bryant gas-fired boilers of 10,000 square feet rating each. The boilers are installed in the existing boiler room of the old building.

Heating of the new building is accomplished by a distribution system which functions in a way similar to that of the cooling system. Water is heated in the master tank with steam from the boiler plant and is pumped to the hot water coils located adjacent to the cold water coils on each floor. From the coils installed on each floor the air is split into several ducts, each duct having its own automatic air mixing damper. In this manner, every major office in the building has individual thermostatic control. The system makes it possible to compensate for the differences in temperatures which occur by reason of different exposures in various sections of large rooms.

The cooling system is designed to maintain an inside temperature rep-

(Concluded on page 51)

RELAX

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in UNLIMITED QUANTITY

• American made—specifically for maximum H_2S removal—LAVINO ACTIVATED OXIDE is available for prompt shipment in any quantity. And, our capacity is such as to assure continuing supply, without interruption.

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Lavino Activated Oxide is disinfected, by a patented Lavino process, to minimise the formation of mold or other fungous growth.

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CLEVELANDS
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In Clevelands, correct design joins hands with "tops" in Quality to produce machines that are definitely leaders in Performance.

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"CLEVELANDS" Save More . . . Because they Do More

Alternative and Auxiliary Gases from Liquefied Petroleum Products

PART 2*

By

C. George Segeler,

Engineer of Utilization
American Gas Association, New York, N. Y.

CHART 2 in this report reveals that higher heating value mixtures have better "C" factors and therefore, could be used to a greater extent for mixing — or if used in lesser replacement gas from the utilization amounts, to give a more satisfactory viewpoint.

Chart 2 also has a propane-hydrogen curve which lies almost exactly in the center of the chart. This indicates what is needed to mix with propane if it is to replace natural gas—a gas of low specific gravity, low heating value and relatively high flame speed.

The "C" factor gives some indications regarding the burning characteristics of the gas. If it is low, then the propane mixtures tend to flash back and the appliance inputs will be reduced. Because they have higher specific gravities than natural gas the primary air-gas ratios will be increased and flames will harden.

Mr. H. O. Loebell has pointed out that occasions for mixing gases do not always require complete replacement of all the natural gas by the substitute gas; particularly in the important case of peak loads will there be substantial percentages of natural gas. Under such circumstances, it would be desirable to know what percentages of various replacement gases could be used without causing a change in the "C" factor beyond reasonable limits.

From the point of view of convenience checking, the mixed gas research formula is somewhat cumbersome, and it would be desirable if a more accurate and convenient index could be developed, perhaps by additional research in the field of high B.t.u. gases.

Table IX shows the heating values of the mixed gases obtained by partial substitution of propane mixtures for natural gas. The values in this table are based on selecting propane mixtures which have a "C" factor of 1.0 with respect to the original natural gas. In effect, this idea is based on starting with completely interchangeable rich propane mixtures and then determining how much the B.t.u. value of the combination with natural gas will be raised. This table is calculated by simple proportions. The objection to partial mixing in this manner is, of course, that the heating value of the mixed gas will be higher than that of the natural gas and thus customers will receive more for their money without proper compensation to the gas company.

The data in Table X indicates the extent to which partial substitution of propane mixtures can be carried out. The numbers in this table are "C" factors, and when they are greater than .85, it may be assumed that the gas mixture would be satisfactory for peak load purposes. For example, the third column in the table shows that almost unlimited quantities of a mixture of propane and reformed natural gas having a heating value of 1116 B.t.u. could be used without serious trouble because even 100% replacement only brings the "C" factor down to .837. The fourth column in the table shows what would happen when a mixture of propane and coke oven gas having 1116 B.t.u. is used to replace natural gas. A little more than 50% replacement gas might be tolerated in the mixture. In the case of propane-blue gas, a little more than 25% replacement gas could be used. In the case of the common propane air, approximately 15% in the mixture would bring you to a "C" value of .85, representing the lower limit of replacement. The position of mixtures of propane and other carrier gases can be readily estimated by reference to Table II.

Table X is felt to be one of the most significant points in the exploration of the possibilities of various gases, and it must be emphasized that it is based on a replacement gas having the identical heating value as the original natural gas. If it can be assumed that a modest increase in B.t.u. might be tolerated, then the percentage of substitution of propane mixtures will be increased. The basis for deciding whether or not an equal heating value mixture must be used or whether the gas company would be justified in giving away extra heat to customers might revolve around economic considerations as to the available natural gas supplies and the cost of the substitute gas. In other words, there are two considerations, one deriving from the physical problems of interchangeability and the other from the economics of temporarily giving customers more than their allotted B.t.u. in order to use more substitute gas and less natural gas. It might also be pointed out that the data in Table X and Table IX forms the limits between which economic considerations would dictate a suitable answer.

Additional details of the properties of replacement gases beyond those shown in Chart 2 are given in the several parts of Table II, each one of which refers to mixtures of propane and a carrier gas. The first line in each part of the table is the "C" factor as computed by the American Gas Association mixed gas research interchangeability formula. The columns in the tables show the variation in the "C" factor as the relative percentage of LP-Gas to carrier gas is changed. The bold face column in each of the parts of the table is that mixture which will produce the identical heating value (1116 Btu.) which was the standard of the original natural gas on which all of the computations were based.

The second line in each of the parts of the table gives the heating value, and, directly below it, in the third line, the corresponding specific gravity.

Then the fourth line furnishes the appliance input in per cent of the original input.

The fifth line is the per cent of natural gas needed versus 100% natural gas based on 100% conversion efficiency of the natural gas.

The sixth line is the same as the fifth based on 80% conversion efficiency.

*Part 1 appears in November issue, pages 49 to 53. Chart 2, page 52. For tables IX and X see page 54 this issue.

TABLE III

GAS COMPANIES USING LP-GASES FOR STANDBY AND PEAK LOAD INSTALLATIONS UTILIZING BUTANE OR PROPANE

July, 1941

Name	*Regular Gas Service*	*LP-Gas and Comment*
Louisville Gas & Electric Co., Louisville, Ky.	Mixed Natural, and Manufactured Gas 900 B.t.u.	Butane. During peak demand, Willien-Stein low gravity carburetted water gas is reenriched with butane and mixed with natural gas to 900 B.t.u. level.
St. Louis County Gas Company, Webster Groves, Mo.	Carb. Water and Natural Gas. 800 B.t.u.	Butane. Carb. Water Gas enriched with butane to 925 B.t.u. standby gas.
San Diego Gas & Electric Co., Escondido, Calif.	Natural Gas. 1100 B.t.u.	Propane-air. Substitute for natural gas primarily for summer months. Oil gas standby plant is kept in readiness in winter.
San Diego, Calif.	Natural Gas. 1100 B.t.u.	Butane-air.
Illinois-Iowa Power Co., Staunton, Ill. (enrichment.)	Mixed Gas. 800 B.t.u.	Butane. Only for enriching manufactured gas to 565 B.t.u.
Peoples Light Company, Davenport, Iowa.	Natural Gas. 1040 B.t.u.	Butane. Experimental use only. Generally use oil for high B.t.u. standby gas.
Iowa-Nebraska Light & Power Co., Shenandoah, Iowa.	Natural Gas. 950 B.t.u.	Butane.
Red Oak, Iowa.	Natural Gas. 950 B.t.u.	Propane. For natural gas engines. See p. 13, Gas Age, July 17, 1941.
Minneapolis Gas Light Company, Minneapolis, Minn.	Mixed Carb. Water and Natural Gas. 800 B.t.u.	Butane. Mixed with blue gas and natural gas to make 800 B.t.u. standby gas.
Lowville Gas Corporation, Lowville, N. Y.	Natural Gas. 1000 B.t.u.	LP-Gas-air. Originally served 537 B.t.u. butane-air gas, changed to natural gas for which 1150 B.t.u. butane-air was gradually substituted. Now serve 1000 B.t.u. LP-Gas-air mixtures.
Allentown-Bethlehem Gas Co., Allentown, Pa. (enrichment.)	Coke Oven Gas. 520 B.t.u.	Propane. Enriching manufactured gas to 520 B.t.u. when necessary.
Coke Oven Plant near Buffalo, N. Y.	Underfiring Coke Ovens.	Butane, propane and flue gases. Replaces coke oven gas for underfiring ovens to meet peak loads.
City (A)	Natural Gas. 1018 B.t.u.	Butane-air, propane-air. 1500 B.t.u. LP-Gas-air for replacing entire town supply in emergency.
Iowa Power & Light Co., Des Moines, Iowa.	Carb. Water and Natural Gas. 820 B.t.u.	Butane. Carburetted water gas (600 B.t.u.) enriched and mixed with butane and natural gas to 800 B.t.u.
Western United Gas & Electric Co., Lockport, Ill.	Coke Oven, Carb. Water and Natural Gas. 800 B.t.u.	Butane.
Nashville Gas & Heating Co., Nashville, Tenn. (enrichment.)	Coal and Carb. Water Gas. 530 B.t.u.	Butane (normal). Experimental use of butane for cold enrichment.
Northwestern Natural Gas Company, Grandview, Wash. (Operate a number of similar.)	Natural Gas. 900 B.t.u.	Butane-air. Following decrease in natural gas, each community was served with 100% butane-air (1100 B.t.u.) in winter. Now planning permanent butane-air service starting in September, 1941.
Public Service Co. of Indiana, Lafayette, Ind.	Natural Gas. 1000 B.t.u.	Cracked Butane-Propane. LP-Gases cracked in water gas set (Steinwedell process) to make substitute for natural gas. Contains 970 B.t.u. and cannot be used 100% for natural gas.
Pacific Gas & Electric Company, Colusa, Calif.	Natural Gas. 950-1050 B.t.u.	Butane-Air. 1300 B.t.u. Standby service for natural gas failure.
Grass Valley, Calif.	Oil Gas. 550 B.t.u.	920 B.t.u. Standby (not operated) for oil gas.
Southern Counties Gas Company, Wilmington, Calif.	Natural Gas. 1100 B.t.u.	Butane-Air. Standby Service for natural gas failure. District tests with 50% butane-air in mixture caused no service trouble or complaints.
Indiana Ohio Public Service Co., Winchester, Ind.	Natural Gas. 1000 B.t.u.	Butane.
Connecticut Light & Power Co., Waterbury Conn. (enrichment.)	Carb. Water Gas. 528 B.t.u.	Butane. Reforming butane in generator fire plus supplementary use as enricher. Produces satisfactory peak load gas.
The Peoples Gas Light & Coke Co., Chicago, Ill.	Mixed, Natural and Manufactured Gas. 850 B.t.u.	Butane. Enrichment of coke oven gas with butane to 800 B.t.u. for standby.
Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y.	Carb. Water Gas. 540 B.t.u.	Propane. Restoring B.t.u. value to State standard.
Haverhill Gas Light Company, Haverhill, Mass.	Carb. Water Gas. 530 B.t.u.	Propane. Restoring B.t.u. value to State standard.
City of Long Beach, Calif., Long Beach, Calif.	Natural Gas. 1070 B.t.u.	Butane-air. Peak load service.
North Shore Gas Company.* Waukegan, Ill.	Coke Oven Gas. 520 B.t.u.	Butane. Replaced coke oven gas for underfiring ovens to meet peak loads. A.G.A. Proc. 1933, p. 778.

* Not using LP-Gases at present.

The seventh line shows the air required for combustion of a cu.ft. of the substitute gas expressed as a percentage of the air required for burning 1 cu.ft. of natural gas.

Although the variation in the "C" factor appears to be the primary point to consider in connection with the various carrier gases, the changes in other properties may also be of interest. The percentage of natural gas required by the replacement gas may limit or enhance the usefulness of a substitute as the case may be and figures are shown in Table II on the basis of 100% conversion efficiency and 80% conversion efficiency. The table also shows the changes in hourly appliance inputs and in specific gravity both of which must be kept within reasonable limits for obvious practical reasons.

The possibility of controlling some of the difficulties of substitute gases by means of pressure changes was not overlooked but it seemed that local circumstances would play the deciding part in determining how far this could be utilized. Therefore, the effect of changing pressures has

TABLE IV

B.T.U. VALUE, GRAVITY, AND COMPOSITION OF LP-GAS AIR MIXTURES USED TO REPLACE NATURAL GAS

Name	*B.t.u. Value Natural Gas*	*B.t.u. Value of Replacement LP-, Gas Air Mixtures*	*Spec. Grav.*	*Composition*	*Max. Percentage of Replacement Gas*	*Comment*
City A	1018	1500	1.45	36% Propane 24% Iso-butane 40% Normal Butane	Up to 100%	Emergency Service only.
City of Long Beach, Long Beach, Calif.	1070	1300-1500,	1.44-1.52	Butane & Propane		Peak load service.
Lowville Gas Corporation Lowville, N. Y.	1000	1150	1.2	Butane in summer; 25% propane added in winter.	100%	Now making 1000 B.t.u. LP-Gas air mixture since natural gas has been completely discontinued.
Northwestern Natural Gas Co. Grandview, Wash.	900	1100	1.32	Butane-air	100%	Gradually going onto 100% Butane air in place of natural gas as supply of the latter decreases.
Pacific Gas & Electric Co. Colusa, Calif.	1015	1300	1.43	13% Iso-butane 86% Normal Butane		Plant particularly standby and has not been operated.
San Diego Gas & Electric Co. Escondido, Calif San Diego, Calif.	1100	1300	Unknown	Butane and Propane		
Southern Counties Gas Company Wilmington, Calif.	1120	1460	1.4	50% Propane 20% Iso-Butane 30% Normal Butane	65%	Actual htg. value varies a little as controls function. Standby service primarily.

not been included in this paper.

Some interesting experiments with inerts added to gas and oil flames have been carried out by Leonard[7] of Washington State College, and these might shed some light on carrier gases. An actual luminous flame can be made non-luminous by the addition of inerts, much the same as by adding primary air. Although this is not entirely new, since the effects of inerts on the luminosity of pilot flames has previously been observed and sometimes caused backfire, nevertheless the use of inerts to the exclusion of primary air in a Bunsen burner, producing a non-luminous flame, is an interesting experiment.

So much for theory. Practice is a different story and the following material has been prepared to summarize the current position of LP-Gases in the gas industry.

Present Status of LP-Gas Use

The requirements for substitute gases intended to meet standby emergency service demands are somewhat different from those resulting from peak load service. Primarily this difference arises from the fact that the consumer would, in an emergency, be tolerant of some departure from ideal conditions while those same people would not be satisfied if they were asked to forego good service under the recurring peak load periods. Therefore, gas companies who are using LP-Gas service for peak load purposes necessarily must be sure that the customers will be practically unable to notice any difference when this gas is furnished.

In considering the effect of mixing a new gas, it is necessary to remember that practically all domestic appliances, and most industrial ones, will operate satisfactorily on a wide variety of gas compositions provided that the characteristics of the gas and the pressure at which it is supplied remain reasonably constant. Although modern American Gas Association approved equipment has a great degree of flexibility, both as regards type of gas and operating pressure, it is adjusted for one specific gas condition, and any new gas conditions must not depart beyond certain margins or else serious complaints are likely to be encountered. Table III summarizes the general results of the operations covered by this survey. As will be noted, some of the gas utility companies on the list in Table III operate more than one LP-Gas plant. The Table shows the type of gas regularly distributed by the various companies and the Btu. value of these gases under standard conditions. Additional columns show the type of LP-Gas service and the manner in which it is applied. A number of the companies indicated that various combinations of propane and butane were used, depending upon the time of the year and the local economies. This implies that the LP-Gas handling equipment has been designed to take care of the higher pressures of straight propane when using the latter. It is also possible that companies securing LP-Gases from refinery sources have a certain amount of unsaturated gases in the mixtures they employ.

Supplementing the information in Table III, there has been appended a bibliography with brief abstracts covering the articles, reports and books believed to be of greatest value to those reviewing this subject. There is striking consistency in the general findings reported by the individual companies in respect to the use of LP-Gases. Installation and operating costs fall close together and similar plans have been adopted for selecting the best gas mixture for using LP-Gases.

Direct Use of LP-Gas-Air Mixtures for Replacing Natural Gas

Reports of the companies in this survey show that suitable mixtures of LP-Gases and air can and are being prepared for replacing any desired percentage up to 100% of the regular natural gas service. In general, the companies have found that the LP-Gas air mixture must have a higher Btu. value than the natural gas which it replaces, thus confining the use of the substitute gas to "emergency" requirements.

However, the City of Long Beach, Calif., decided that the economics of high Btu. LP-Gas-air mixtures were favorable in contrast with oil gas operation and with the demand charges on purchased natural gas.

Table IV shows the heating value and gravities actually employed by the companies who are using LP-Gas air mixtures to replace natural gas. It has also been well established by test both in the laboratory and in the field that there is a certain optimum mixture which is best adapted for replacing a given kind of natural gas. Even so, there are almost always some gas appliances which will not operate satisfactorily on any mixture of LP-Gases and air. Tests made by several gas companies showed that an upper as well as a lower limit of permissible Btu. values could be estab-

TABLE V
SUMMARY OF LP-GAS USE AS ENRICHER FOR MIXED, NATURAL, AND MANUFACTURED GASES

Name of Company	*Normal B.t.u. Value*	*Use of LP-Gas*	*Method of Use*
Iowa Power & Light Company Des Moines, Iowa	Water and Natural Gas 820	Standby	600 B.t.u. carburetted water gas enriched to 820 by butane mixed with natural gas.
Louisville Gas & Electric Co. Louisville, Ky.	Mixed Gas 900	Peak Load	Willien-Stein low gravity carburetted water gas, reenriched with butane and mixed with natural gas to a 900 B.t.u. level during periods of peak demand.
Minneapolis Gas Light Co. Minneapolis, Minn.	Mixed Water and Natural gas—800	Standby	Butane mixed with blue gas and natural gas to make 800 B.t.u. mixture. Primary use while starting up additional oil-gas generators producing 650 B.t.u. oil-gas cold enriched by butane to 800 B.t.u.
The Peoples Gas Light & Coke Co. Chicago, Ill.	Mixed Gas 850	Standby	
Peoples Light Company Davenport, Iowa	Natural Gas 1040	Experimental	Experimental cracking of butane in water gas set.
Public Service Co. of Indiana Indianapolis, Ind.	Natural Gas 970	Peak Load and Standby	Butane or propane cracked in three shell water gas set using Steinwedell process to produce substitute gas of .65 specific gravity and 970 B.t.u.

lished. Between these limits, there would still be many appliances which would not operate satisfactorily on the substitute gas, but the degree of dissatisfaction varied widely among the several companies. Some found that it would be necessary to keep some natural gas in the mixture in order to be sure that only a small minority of appliances would be unsatisfactory. Other companies apparently were able to utilize higher percentages of LP-Gases up to complete exchange.

The report of operation of the Southern Counties Gas Company's butane-air plant at Wilmington, obtained in the 1939 Proceedings of the Pacific Coast Gas Association, page 112, is of considerable interest because of the detailed information that this report furnishes on the appliance utilization with various gas mixtures.

Since no emergencies have been reported since the erection of the standby plant, it is impossible to judge what the practical limits would be if a real test should occur. The experimental tests run by a number of the gas companies show that it is advisable to leave some natural gas in the mixture in order to eliminate customer complaints, but in a true emergency, it would be better, if not absolutely necessary, to utilize LP-Gas-air to the fullest extent and to cope with such complaints as they arose. Discussion of this point would be academic in an actual situation, but there is a divergence of opinion as to the desirability of 100% replacement of natural gas by a high Btu. air mixture. The Southern Counties Gas Company's statement on this point is quoted below:

"Our entire requirements for firm gas consumers (excluding surplus industrial) can be taken care of for several days by the butane-air standby plant. However, it is our intention never to exceed 65% of butane-air in the mixture sent out unless a higher percentage is unavoidable."

A contrary view is expressed by the Lowville Gas Company of New York and the Northwestern Natural Gas Company of Washington, both of which have been faced with diminishing natural gas supplies and which have consequently gone over to 100% butane-air service taking care of any complaints as they arose.

Practically all of the gas companies have reported that consumers notice the greenish color of the butane-air flame as compared to the purplish blue color of the natural gas flame. This difference gives rise to some customer calls which should not be regarded as complaints.

Discussion of the economics of butane-air standby compared to other methods of standby is included in the Southern Counties Gas Company report already referred to and also in the report of the San Diego Gas and Electric Company. The former company concludes that there is a big disparity in cost in favor of butane-air based on the actual cost data available to them from a nearby oil-gas plant, the principal reason for the disparity being the high investment per-unit of send-out capacity. In the case of San Diego, the oil-gas plant was already in existence and is maintained ready for standby in the winter in addition to standby available from the butane-air service. In the summer months, when the generators are cold, the butane-air plant would be used to maintain service in case of a natural gas outage during the time required to start up the cold oil-gas generators. This arrangement is satisfactory because the summer load is so much smaller than the winter load which includes heavy demands from house heating.

Two additional LP-Gas-air systems for peak load and emergency will be placed in operation in a few months. They will both be in Canada.

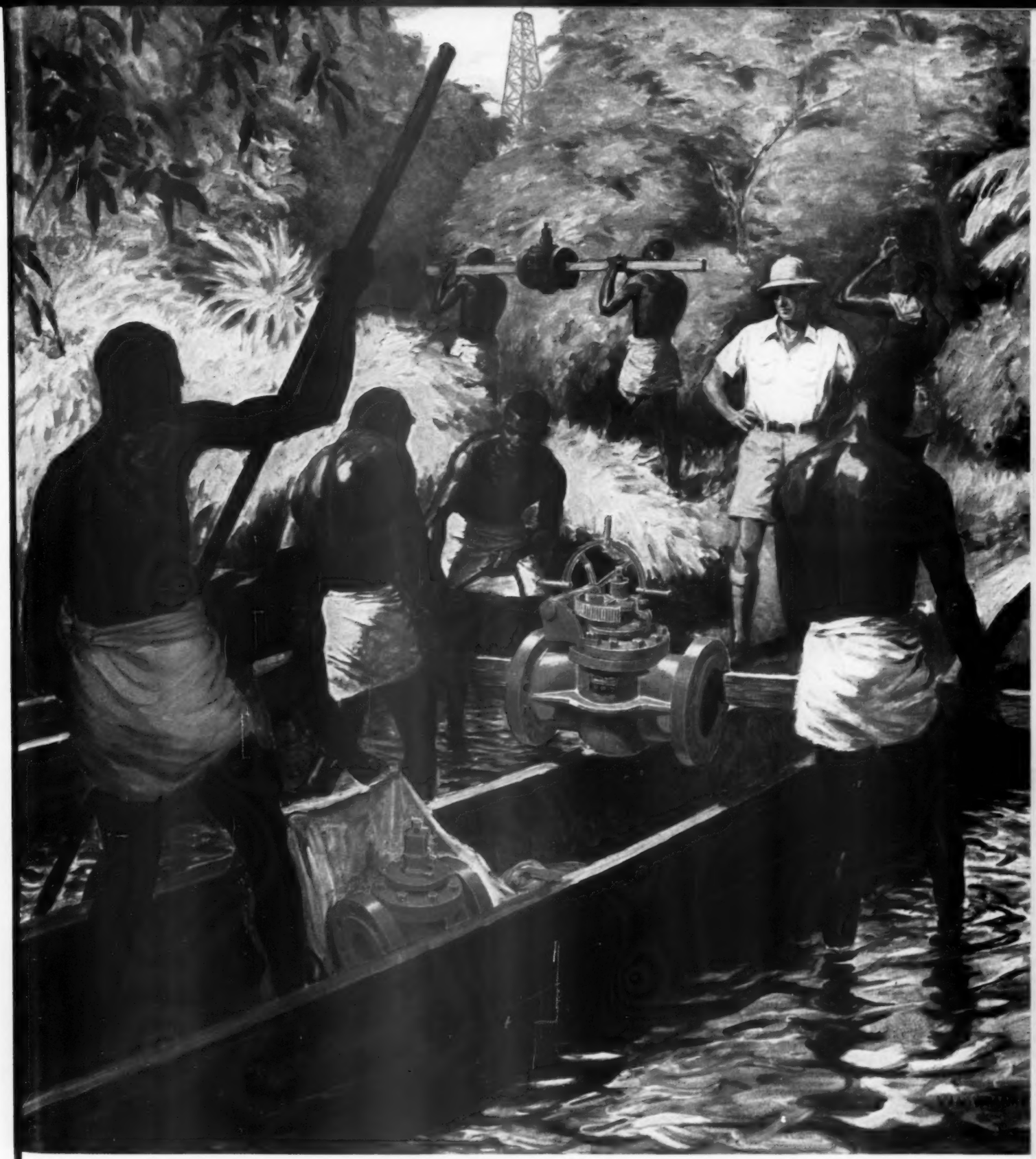
No discussion of numerous cases in which large industrial natural gas customers own and operate standby LP-Gas-air plants has been included in this survey. Practically all of these plants are going to use an air-gas ratio which will require no burner readjustment, this being practical inasmuch as no state Btu. standards are involved. Data concerning these plants will be found in current trade literature.

Application of LP-Gases to Enrich Water Gas as Natural Gas Substitute

The method of utilizing LP-Gases suggested by the title to this section is practiced by a number of companies who are supplying various types of mixed, natural, and manufactured gas. These companies do not send out any LP-Gas air mixtures but use various methods for mixing butane or propane with water gas and then, in turn, mix this with natural gas to maintain the burning characteristics as close as possible to the normal. Some increase in the specific gravity of the gas occurs as a result. In the case of some of the companies, the LP-Gases are merely mixed at the outlet of the carburetted water gas equipment to the required Btu. value as, for example, in Des Moines, Iowa, where 600 Btu. carburetted water gas is enriched to 800 Btu. with butane and then mixed with natural gas as required.

In Minneapolis, the use for LP-Gases is in a similar manner, although butane is mixed with blue gas and natural gas to make an 800 Btu. mixed gas with an increase in the specific gravity from .69 to .79. The Minneapolis plant is so devised that if a shortage of natural gas occurs, butanes can be used to enrich blue

(Continued on page 52)



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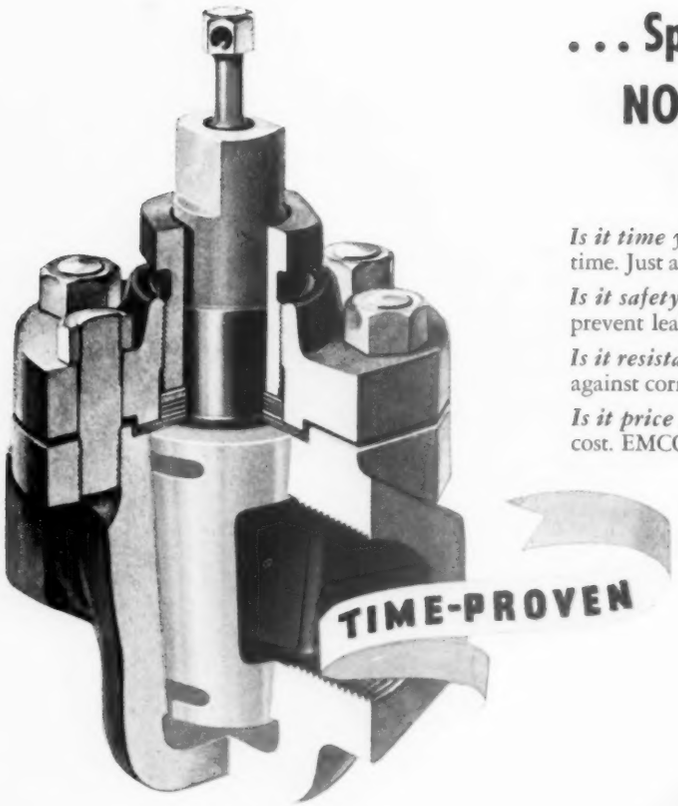

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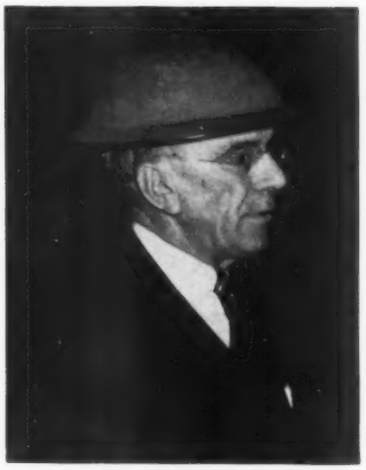

Photo, A. Gordon King
Frank M. Roessing

Conditions in England as Viewed by An Official U. S. Observer

from a talk by
Frank M. Roessing
Director of Public Works
Pittsburgh, Pa.

This report is taken from a talk given before the A. G. A. Technical Section at Atlantic City, October 20, 1941. In introducing Mr. Roessing, the Chairman said: "Mr. Roessing was chosen as a member of a committee of five to make a trip to England—I believe he was there some six weeks—studying the matter of taking care of public service under blitz conditions."—Ed.

As THE Chairman said, I was selected, with five others from the United States, to go to England to study and observe their A. R. P. methods. When I say A. R. P., Air Raid Precautions Service, it is the same as our Civilian Defense here. I was given twenty-four hours notice to go down to Washington and get my passport and get up to New York and get a Clipper.

Our first stop was Bermuda. You know both the English Government and the American Government are fortifying Bermuda now. They pull the blinds in the Clipper about two hours before you get there, so you can't see anything. We only stayed long enough to refuel and hopped off to the Azores. That was a night ride. Then from the Azores we went to Lisbon, Portugal.

In Lisbon—that is now the melting pot of Europe — all the refugees from different European countries are trying to get out of Europe, trying to get somewhere else. They told us that they were offering $5,000 for a seat on the Clipper, and had been there for a year waiting for a chance to leave. The passenger list of the Clipper is made up by the State Department of the United States, and the passenger list on the British Overseas Airway to get from Lisbon to England is made up by the British Government. Both countries use Lisbon for an outlet to the world.

We changed to a land plane there; and right back of us at the landing field was a German camouflaged plane, four motor, ready to take off to Berlin as soon as we got out of the way.

The land plane which we took was an old Dutch plane; the windows were blacked off with permanent black cardboard. They don't tell you where you are going. Sometimes they land in Scotland, sometimes in Wales, sometimes in Ireland, and there are 132 different landing fields in England.

There is an agreement between England and Germany that they won't shoot at each other's passenger planes out of Lisbon; but two British planes have been shot down, and this one we were on had forty or fifty holes in the fuselage which were, apparently, bullet holes.

We finally hit the ground. When they opened the door, there was a company of British soldiers around the plane; and we realized we were at least in a strange country. They hustled us through this military reservation to the station. We were met by the Consul and several British Government officials and, as I say, hustled down to the station for a train to London.

Americans now in England are the fair haired boys. They are most appreciative of everything or any little help that we have given, and they showed us the utmost courtesy and consideration all through the trip.

We were met in London by the Secretary of the American Embassy and other British officials; and taken to the Claridge Hotel for dinner. Of course we had a lot to talk about and a lot of questions to ask, so I suppose around twelve o'clock we were all ready to go back to our hotel. The British Government recommended the Cumberland Hotel to us. That is a new steel frame, reinforced concrete structure. Buildings of that type have been giving much better account of themselves than any other type. Don't forget, England is old. Their buildings are a hundred, two or three or even five hundred years old, made with brick, stone and mortar; and they don't stand much tampering with. That is really the cause of so much destruction over there. I don't believe we will have that experience. Our buildings, especially in our metropolitan cities, are mostly steel frame structures.

We decided to walk up to the Cumberland and one of the Embassy men said he would lead the way. After going through two or three black painted revolving doors, we got out to the sidewalk; and had our first experience with a black-out—and when I say black, I mean black. How any metropolitan city of the size of London can exclude all light is beyond me. What becomes of the starlight or moonlight, I don't know, unless it is their narrow crooked streets and their black wood block pavement. None of it certainly reaches the streets of London. Taxicabs keep running, buses keep running. Moving vehicles have only a small headlight, and it is covered over so that the bottom of it throws the light right down on the pavement and doesn't extend more than ten or twenty feet in front of the machine. That is absolutely no good to the driver, but does give the pedestrians a chance to see that something is coming. Curbs are painted here and there with white strips similar to our traffic markings, and the bottom of the lamp posts are painted white. We travelled from the Claridge up to the Cumberland as a chain gang with our hands on the shoulders of the man in front.

That night, by the way, after we got rid of all these officials, we decided to go down to the subway station, right next to the Cumberland, from sixty to seventy feet underground,—they had escalators to get back and forth. Their subway stations are very similar to ours,—long concrete platforms about twenty feet wide and depressed tracks. That night there were two thousand people sleeping on the platform; very few of them had anything under them. Some of them had pieces of mat-

tresses or blankets or rugs of some kind, but most of them were lying right on the concrete. Trains were going through every minute or two, and they left about two feet between the edge of the platform and the sleepers for passengers. Lights were shining brightly above. How those English people could sleep under those conditions, I don't know; but night after night they go down into such places to try to get a night's sleep.

We talked to the warden in charge. I said: "These people never did have a home?" He said: "Oh, yes, they did. They have their places. Their homes have been destroyed or they are just afraid." The English, as you know, have more or less of the herding instinct. They build their houses close together, and these people seem to feel safer with someone and a little bit underground.

I saw a shelter in Manchester, which is an old abandoned ship canal —to be no more than a big brick sewer, water dripping through the roof, about a half inch of water on the floor, about thirty feet high, arch shaped, forty feet wide; and there were twenty-five hundred people sleeping in there the night I visited it. I only saw one bed in the whole shelter, and that was occupied by six children lying head to feet, ages about six to twelve.

The English authorities are trying to get their people out from underground. These high explosives will penetrate the ground for fifty feet, and then they go off and shatter the ground for twenty feet further; so, to be absolutely safe, you have got to be eighty to a hundred feet underground. It is quite difficult to get a place like that which is sanitary and capable of being ventilated.

In this particular shelter in Manchester the warden showing us through asked us to go up to one end to talk to an old lady. She had to sit up in a rocking chair all night. She had a heart condition. This was about two o'clock when we talked to her and we asked her "don't you get tired by morning?" "Oh, yes, my back gets tired about three or four o'clock, but we will lick them. We will lick them." We asked her how old she was. She said ninety-six. That was indicative of the English spirit.

I spent all the off-moments I had on the streets. I was interested in street cleaning and things of that nature. I talked to the fellows with the brooms, or the truck drivers, taxicab drivers, hotel doormen, and they all have the same feeling. They are willing to do anything to win the war.

A direct bomb hit on a gas holder in England caused the damage shown in this picture. As can be seen, there was no fire or explosion following the hit. The group below are A.R.P. workers ready for their vital tasks

Many and many a British official told me "we don't want your men. Send us the tools and we will finish the job."

Our first day was spent in Scotland Yard, which is no more or less than a police headquarters. After all, we were aliens. We had to be registered, finger-printed, photographed, etc., and given cards of identification.

I feel, if England wins the war the women are going to do it for her. They are doing everything a man will do over there and doing it better in most cases, with more women in the military service than there are men.

Up in Birkenhead we went through Lever Brothers soap factory. They make Rinso. They had sixty-five hundred employees in this plant. The Government notified them to replace twenty per cent of the personnel with women. They made plumbers, pipe fitters, electricians, wheel-wrights, machine operators, everything out of those women, and their production went up. The general manager taking us through the plant and telling us about this exchange said: "I wish the Government would make us replace all our men employees."

We were fortunate enough to go down to Dover. There the R. A. F., the Royal Air Force, has dug back into those chalk cliffs, has tunnelled back in there two or three or four hundred feet. Their observation rooms and their headquarters are back in these chalk cliffs; and I saw more women back in there than I did men—in dark blue natty uniforms, little overseas caps, etc. A big British major showed us around. I asked him how they were getting along with the women, "Oh," he said, "fine. When we first took them on, we were a bit concerned, but now, by God, we couldn't get along without them."

The civilian population of England is pretty much up against it. They haven't got enough food, and they haven't got enough clothes. Very little sugar, no cream, no butter—they have a little bit of oleomargarine—no fresh fruit; the bread isn't black but it is almost there. They do have plenty of vegetables, or potatoes, peas and beans, but no onions for some reason or other. There are signs all over England: "Grow Onions." They have very few cigarettes. If you go to a tobacco shop some place, you get in line and hope the cigarettes will last until you get to the counter. If they do, they sell you one pack of what they have. They have no choice. So having stood fifteen or twenty minutes, you get a pack of five cigarettes —they even put them up in such small numbers.

We were given ration cards in Scotland Yard, both for food and for clothes. A man gets enough coupons to buy a hat, an overcoat, suit, and pair of shoes a year. If he needs any socks, underwear or anything of that nature, he has to do without a hat or coat. The ration cards are little coupons. One coupon is for meat, another for cooking fats, etc. You can use your food coupons for clothing coupons. It doesn't make any difference how much money you have, you have got to have coupons to buy anything; and a housewife has a pretty tough time of it.

England is the country of roast beef, but I never saw a piece of roast beef or steak all the time I was there, never saw any red meat; only had roast mutton once and that was at the luncheon that his Royal Majesty gave this mission.

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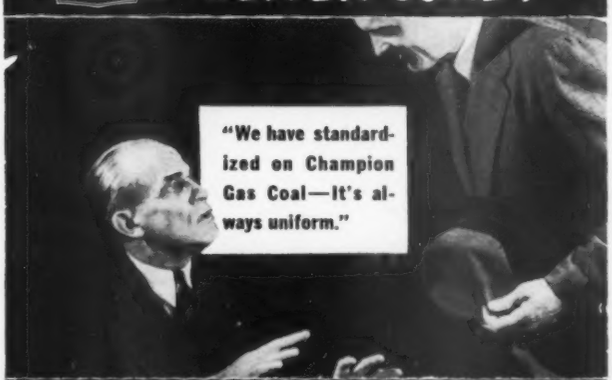

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They have made eighty million gas masks and distributed them to everyone in England. The civilian gas mask is good for two hours to protect against any known war gas; it is no good for coal gas or CO_2 gas of that type. They are urging their civilian population to carry them at all times. The Military has to carry them. All government officials or official in the government employ, police, firemen, anyone of that nature, is compelled to carry a gas mask.

They also gave us helmets at the same time. These things have to be carried by anyone connected with the government. The police wear them most of the time. The A. R. P. personnel wear them most of the time. They are heavy and uncomfortable and no good for a fast travelling splinter; but they have saved many a cracked skull from flying debris, flying brick and things of that nature.

They haven't had any gas yet, but they fully expect it before the war is over. They have spent many an hour training decontamination squads. Those poor fellows have to go through the drills day after day and as yet they have never had any practical use. They have laundries for washing decontaminated clothes. They have got up a gas detector paint. It is yellow, and turns red in the presence of gas. England is just covered with that yellow paint, on any likely space they can get,—tops of fire plugs or such places. I saw one of their training squads where they demonstrated phosgene and chlorine. They turned both of them on this paint, and it was amazing how quickly it turned red. There was no mistaking it at all. It turned very much the color of red lead.

It has been the custom in English and German air raids to come over in squadrons with anywhere from a hundred to a thousand planes at a time. The first batch of planes carries incendiary bombs.

An incendiary bomb has a firing mechanism inside, consisting of a plunger, spring, etc. with a blank cartridge on top. It is loaded with thermite. The blank cartridge sets off the thermite, and the bomb itself is made of magnesium. Magnesium burns at a temperature of 4600 degrees and looks very much like some of our Fourth of July fire works. It blows off a white fire to a distance of six, eight or ten feet. England first learned to combat these with sand bags. They don't bother with any other bomb protectors or fancy contraptions. They haven't done away with them but don't use them so much and don't recommend them, but every place in England has sand bags. In the cities each street corner would have ten or twelve piled up against the building, and every twenty feet along the sidewalk there would be two or three.

When an incendiary drops it is the duty of anyone to grab a sand bag and smother it, and it does it very quickly. If they stick in a roof, —of course 4600 degrees will go through most roofing material pretty quickly.

England has developed a stirrup pump very much similar to our garden pump for spraying bugs. You take a bucket of water, throw the suction hose into the bucket, put your foot on the pump on the bottom, put one hand on the pump handle and hold the nozzle with the other. The use of a water stream will spread the fire from these incendiaries; but a spray will quench them if properly applied. They throw the spray to the bottom of the fire first, get the floor or ground wet underneath, then gradually pull the spray up over the bomb and it is quickly quenched.

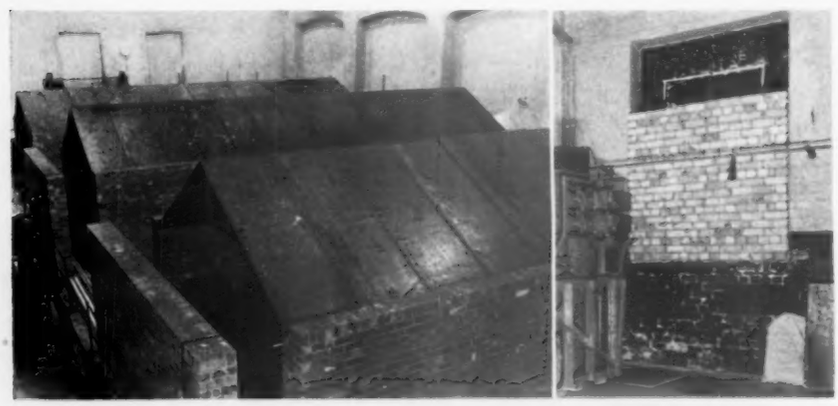
The second bunch of planes carry high explosives or land mines. I have seen high explosives, that didn't go off, ten feet long, twenty inches in diameter with a piercing point, probably between eight and ten inches thick. I suppose they use them for armor piercing as well as for land work.

As I said before, those bombs will penetrate the ground for fifty feet but there has been more damage done lately with land mines. A land mine is similar to any other mine, about three feet six or four feet in diameter, about two feet six or three feet high. They let them down in parachutes.

Those bombs go off as they hit the surface. They are loaded with from two thousand to twenty-four hundred pounds of high explosive, usually TNT; and you can imagine what kind of an explosion that will make. It is sometimes felt for a mile in every direction. Anything close to it is blown down but the most damage is done by the return of the air to the center of the explosion, causing a vacuum. That vacuum has got up as high as ten inches. Most buildings are designed, as you know, to stand a wind pressure, or pressure on the outside; but I don't know of any building designed to stand a pressure from the inside caused by a vacuum on the outside; and those old English building walls just bulge out and the roof comes in.

Human beings are less able to stand a vacuum than buildings. They found numbers and numbers of people dead after a land mine incident. They couldn't see any marks, any bruises of any kind, couldn't determine what had killed them, so, after a few post mortems they found that their lungs had been sucked up toward their throats, causing hemorrhages; and they just passed out.

Fortunately the Germans have been very poor marksmen. They have followed railway lines for miles without hitting the track, but the small border towns on the side have been severely damaged. They followed the Thames in London night after night—London last winter had fifty-two nights of all night raiding from eight at night until eight the next morning—but they have never hit a bridge in London. They have hit a couple of approaches; but these have been repaired, and all the bridges are functioning. Those beautiful docks at Liverpool, miles of them, have only hits on about a hundred feet; but they have bombed the City of Liverpool all to pieces. Down at Dover they haven't touched the docks. The English think they are saving the docks for invasion purposes; but the town of Dover is almost shot to



These brick walls and metal coverings protect utility machinery from damage by bomb splinters. At right is an interior view of a window which has been bricked up and blacked out for the protection of workers

pieces. Southampton is sixty to seventy per cent destroyed.

I got my information before I went over from newspapers and magazines, but I felt, when I got there, that the damage was worse than I had any idea of. In London it is spotty. You can see blocks that are totally wiped out, and then you will see blocks that are not touched.

England is learning two definite duties. Their Civilian Defense Act was passed May 10, 1935, four years before they got into the war. The officials immediately started trying to interest the civilian population in organizing for their own defense, but they said that nobody was going to butcher their women and children, and it wasn't until the first Jerry dropped that they commenced to be interested in their own defense. They were all prepared then for daylight raiding, and the Heinie fooled them and gave them night raiding. They had to reorganize and prepare all over again. Had England listened to the officials and got ready, organized for their own defense, there wouldn't have been nearly the amount of damage done or the number of lives lost.

There has been more damage done by fire than explosions. Several British officials told me they considered that 70% of the damage had been done by fire.

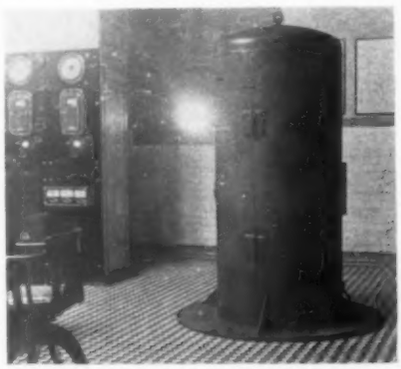
When a high explosive bomb hits in a street I have seen craters sixty to eighty feet in diameter, and thirty, forty or fifty feet deep,—the sewer line, water line, gas line, electric conduits, everything gone. Gas usually starts a fire if the explosion doesn't. Firemen come out, but haven't any water, and have to watch the town burn down, or a good part of it.

Now they have developed their trailer pump, a little fire pump on two rubber tired wheels. They can draw this by hand or put in the back of a machine. It consists of a Ford motor connected to a fire pump. They have established what they call static water throughout the cities, steel tanks forty feet long, ten feet wide, four or five feet deep. They are kept on the sidewalk in the cities. They can draw one of these little pumps up to a static tank, throw the suction hose over into the water, and they have four outlets for hose connections in the pump end. As soon as they pump one tank dry they can run to another. In lots of cities I saw steel lines lying in the gutter throughout the town, apparently fire lines from some source of supply. If a property owner will clean up the debris in his place, and make the foundation so it will hold water, his taxes are rebated.

Had such things as that been done promptly there wouldn't have been nearly the amount of damage that there was.

I am wondering if we are not going to have the same experience. I am not a war monger and I am not any propagandist. Nobody is paying me for anything, but I can't help thinking of one of our party who couldn't get a Portuguese visa to go with us on the Clipper, so they sent him over on a bomber. He jumped from Newfoundland to somewhere in Scotland in nine hours and fifteen minutes, and the bomber had enough gas to go back to Newfoundland if he couldn't land in Scotland.

If England does get licked or their fleet scattered, a couple of airplane carriers could come over here off the Jeresy coast.



An air raid shelter in the office of an English utility.

You men are particularly interested in gas. London last year had 10,681 gas mains broken. 346 of them were 48 to 60 inch; 334 of them were 24 to 36 inches. Are any of your companies ready to take care of such number of breaks? It won't cost you anything to think about it. I don't say you are going to get it. I think we have as much brains as the English people, sometimes I think we have more. I think we will probably be in a little better shape if we will just use our brains.

You men in the gas game can't possibly take care of your own company in case of a severe catastrophe. You have got to rely on mutual assistance. Why not plan it now? Doesn't cost anything. I am not recommending that anyone spend any real money.

When we came back, we made twenty-five preliminary recommendations and one of them was maps. I doubt whether there is a municipality in the United States which has a decent map of its utilities. I know in Pittsburgh we haven't. We have a man eighty-five years old, and when

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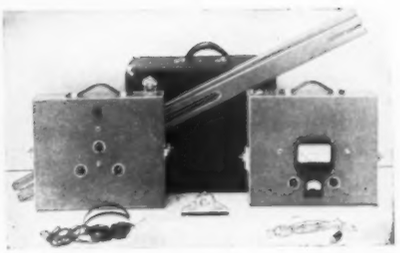

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the necessity arises we send a car for him to come out and show us where the valves are. I don't doubt there are other cities the same way.

A lot of English destruction, I think, is due to their old gas systems. I don't believe they know what valves are. They haven't any curb cocks in their service connections, so that if a main is broken or anything is broken the whole system is gone. Since the war they have been putting in valves, but now when there is a break they have got to use a rubber bag, they have to get down in that crater and stuff a bag into the end of the broken main. I saw a contraption for shoving a bag through a service connection into the main and then blowing it up after it got in there.

The gas companies take care of their own repair work. By the way, everybody damns the gas company and the water people. How come? Because there has been so much damage, so much trouble due to burst mains, etc. When they get them connected up they tell us over there if you open your gas cock on the kitchen range water spurts out, and if you go to the bath room and open the faucet gas comes out. There is a co-ordinating gas commission in London handling all the gas companies throughout England, but they are supposed, the same as the other utilities, to take care of their own repairs. I don't doubt they get some government aid. They would have to.

I spent a day in a gas works at Birkenhead. They had three direct hits in one night. The plant was all tied together with haywire. Their conveyors were all gone, but they were wheeling their coal in wheelbarrows; and they told me that after the blitz they were making gas in forty-eight hours—again showing the English spirit.

Going through the country of England it seemed to me that they are very well protected against invasion. Every level field in the country is a mass of wires to stop airplane landing. Every city and town is protected with a balloon barrage, these large sausage balloons; you could see 192 from my hotel window in London. They have pill boxes every place. I think the entire output for the last ten years of barbed wire of the American Steel and Wire is over there coiled up and strung ready to use. I have seen haystacks in the country made into pill boxes.

They told us every bridge in England was mined ready to connect up and blow up; large concrete blocks in the roads. Lots of roads are even blocked. You travel along, and you have to run off the road and run around these tank barriers.

But there was an Army man in Pittsburgh not long ago talking and explaining from a military standpoint how easy it would be to invade England. From what I saw I would hate to be in charge of the invading troops.

Talking about shelters, they have taken over one entire university over there, and all the professors are working on experiments trying to develop different things for protection. They have shot off all kinds of different shelters, and they are now ready to recommend a small re-enforced brick shelter that will hold six people. Under actual blitz conditions these have been knocked off of the top of two story buildings and the shelter has not been destroyed, with one incident where two of the occupants were killed but the other four were not even seriously injured. England for the first time is ready to recommend that type of shelter. They have employed these public shelters since shortly after the war started, but they want to get the people separated and dispersed into smaller groups.

The black-out of industrial buildings and plants is a real problem. I saw a lot of buildings with a temporary building over everything. They use steel scaffolding such as the contractors use, with clamp joints. They make a frame of that and cover it over with some sheet steel or even tar paper, or some light building material that will stand the wind. The entire building is covered.

Their mill buildings, etc., are smaller than ours. Take their blast furnaces, they feed them with a wheelbarrow,—little bits of things. What we are going to do with our thousand ton blast furnaces and our big open hearth plants and our Bessemers I don't know, but I feel the steel companies have enough brains to meet the situation if it becomes necessary.

Peerless Manufacturing Co. Distributes Display Card

An attractive display card for window or counter use, giving "ten reasons why" to use gas heat has been distributed to their customers by Peerless Manufacturing Co. of Louisville, Ky.

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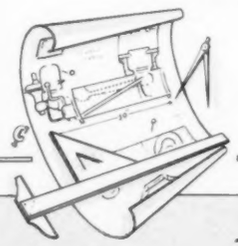
For this help we owe—and now express—our sincere thanks. We shall need similar team-work again during 1942. May we count on you?



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53 PARK PLACE NEW YORK

These Charts Tell The Motor Truck Story In An Interesting Way

By
W. F. Schaphorst, M.E.
Newark, N. J.

Fig. 1 is a chart that I developed and copyrighted nearly a quarter of a century ago—in 1917. It was published in 1917 and aroused considerable interest because it showed clearly the relationship between capacity, cost, and expectant mileage.

Thus for example the dotted line drawn across the chart showed that a two-ton truck (column A), costing $4000 (column B) had an expectant mileage of about 63,000 miles (column C). But that was a quarter of a century ago.

Fig. 2 which is "up-to-date," shows that there has been a vast improvement in trucks, especially as regards cost. Thus the dotted line drawn across this new chart shows that the same expectant mileage (63,000 miles) goes with a truck costing only $1000 as compared with $4000 a quarter of a century ago.

To be sure, nobody can tell definitely, beforehand, how far any new truck is destined to travel before consignment to the junk pile or junk dealer. At the end of 100 miles the truck may be completely ruined through an accident. At the end of 5000 miles it may be prematurely worn out through recklessly poor care. Or, it may run 200,000 miles because of extra good care and still be good for more. So much depends upon care that a strict mathematical determination of truck mileage is well nigh impossible. All that can be done is to build up an "average formula" based on actual average service under reasonably good conditions, and it will give "average" results.

This chart is based upon such conditions. It gives the mileage that can be reasonably expected from a truck of any cost between $500 and $10,000, and any capacity between one and ten tons.

If you operate a truck, or a fleet of trucks, you will be interested in learning whether you are "beating" this chart or whether it seems to exact a mileage that is too high for your conditions.

Or, if you are contemplating the purchase of a new truck the chart will prove useful in helping you to determine whether or not that truck may be a good "buy."

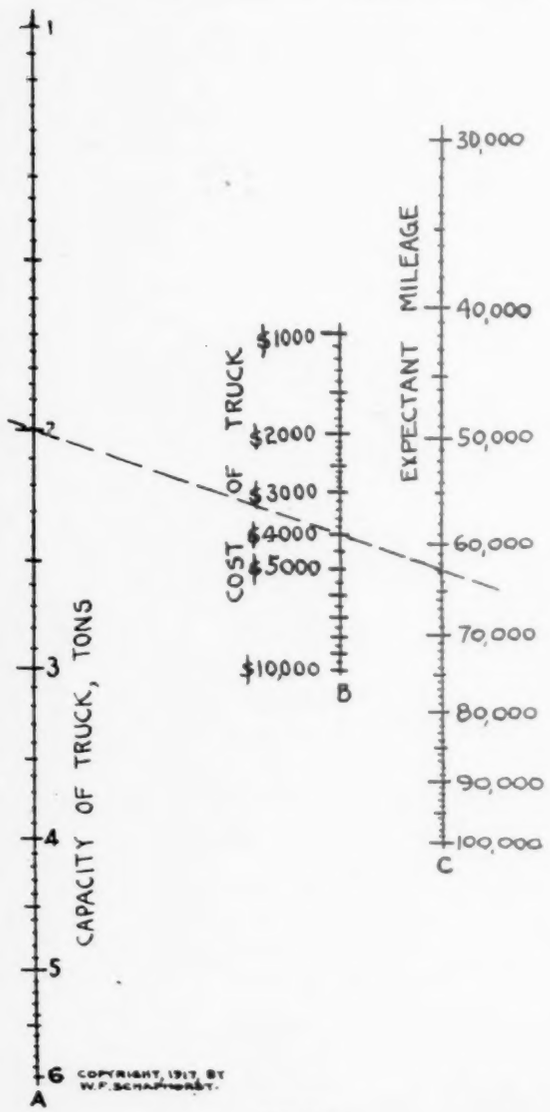

FIGURE 1

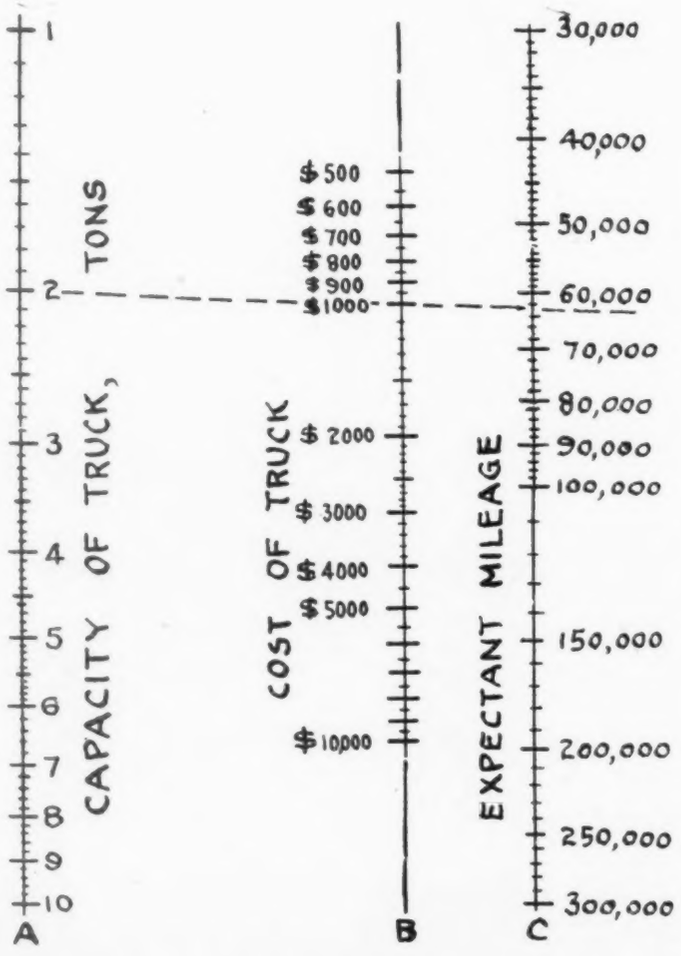

FIGURE 2

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"Your purifying materials stand up the best of any I have ever used and always revive perfectly."

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Relative Cleanliness and Costs of Gas and Electric Deep Fat Frying

By
Frederick Crompton
President,
Golden Brown Appliance Mfg. Co.
Lynn, Mass.

APPARENTLY the most vulnerable spot in the commercial cooking gas load today is the deep fat fryer. A recent survey of hotel and restaurant kitchens in some of the larger New England cities has disclosed a number of electric fryer installations.

Just why this condition exists is beyond the scope of this paper. There are probably several contributing factors, which, when added up in certain cases, allows an entering wedge for our younger brother the electric man.

It is not enough that the economics of the entire picture favors the correctly designed, temperature controlled, immersion tube gas fired, deep fat fryer. The manufacturer must constantly improve his product, the gas company must render quick service when called for, and together they must keep the restaurateur continually informed. Otherwise, this part of the gas load can and is being lost, making the coffee makers and water urns the next point of attack. Our competitive fuel salesman then tells the customer that it will cost less for himself and his wife to go downtown in one car rather than in two cars, and presto, we have an all electric commercial kitchen.

It behooves the gas man to investigate seriously the deep fat frying equipment on his lines.

The gas fired, immersion tube fryer has proved itself during the past ten years as being the most satisfactory and practical method for this kind of work. Compared to the open top, underfired kettle, fat consumption is reduced up to 50%, while gas consumption is reduced approximately 33%. The reasons for this are that a cool zone of fat is located below the heated tubes into which small food particles fall by gravity, thus preventing carbonizing and excessive fat breakdown, and the immersion heated tubes have proved to be the most efficient method of transfering heat to the cooking fat.

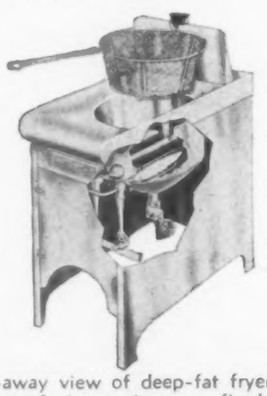
On July 15, 1940 the American Standards Association endorsed the Approval Requirements for Hotel and Restaurant Deep Fat Fryers as submitted by the A.G.A. committee on this project, to become effective January 1, 1941. These requirements represent minimum standards for performance, safe operation, and substantial and durable construction. As minimum standards they do not preclude the embodiment of ingenuity of design and improvement and are not to be construed as a measure of quality beyond compliance therewith. The various provisions and tests prescribed are based on years of experience in the utilization of gas and the results of extensive research. They are designed to protect the public to the extent of making gas a more safe and economical medium of heat through the use of appliances, the safe and efficient performance and substantial and durable construction of which are assured.

A few of the requirements fundamental to a deep fat fryer are briefed as follows:

Cooking Vessel

The cooking vessel and splash deck shall be constructed without seams which might absorb, collect, or allow the passage of grease.

Where the cooking vessel is constructed of sheet steel, it shall be .10% to .20% carbon, cold rolled or hot rolled and pickled sheet steel of a thickness not less than No. 14 U. S. Standard Gage.



Cut-away view of deep-fat fryer shows position of immersion gas-fired tubes. Depth of fat above these tubes is six inches.

Splash decks shall be pitched ¼" per foot or more toward the edge of the cooking vessel.

The cooking vessel shall contain a low temperature crumb receptacle below the firing zone into which all crumbs will fall by gravity.

Each cooking vessel except for counter model fryers shall be provided with an oil drain pipe and valve with a minimum inside diameter of 1" iron pipe size.

Thermal Efficiency and Capacity

A deep fat fryer shall have an operating efficiency of not less than 60%, and shall have sufficient heating capacity to evaporate one inch of water from the cooking vessel in not more than 30 minutes when tested as follows:

The fryer is filled with water to the normal cooking level, and this level is marked on a connecting gauge glass. Additional water is then added to bring the level ¼ inch above this mark, and the fryer lighted and thermostat turned on full. When this additional water has boiled away, bringing the water level back to the mark on the gauge glass, an accurately weighed and previously measured inch of water, approximating room temperature, is poured into the cooking vessel. At the same instant the time and the gas meter reading is noted. When the weighed inch of water has boiled away, bringing the water level back to the original mark on the gauge glass, the time and meter reading are again recorded. The temperature and pressure of the gas at the meter, as well as barometric pressure, are also observed, to correct the amount of gas used to standard conditions of 30 inches barometric pressure and 60°F.

$$\text{Efficiency} = \frac{\text{Wt. of 1" water) (970 + 212 - Tw)} \times 100}{\text{H Q F}}$$

Where:
- Tw = Temperature of water added,
- H = Gross heating value of gas, Btu per cu. ft.,
- Q = Cubic ft. of gas used,
- F = Factor correcting gas to 30" mercury barometric pressure of 60° F.

As an example a certain deep fat fryer tested as follows:

One inch of water (weight 7 pounds, at 74°F) was evaporated in 24 minutes and 15 seconds and consumed 24.30 cu. ft. of 535 Btu gas. The gas meter pressure was 6" water column at 90°F., with the barometer reading 29.60" Hg.

$$\text{Efficiency} = \frac{7 \times (970 + 212 - 74) \times 100}{24.30 \times 535 \times .918} = 64.9\%$$

The preheating efficiency of a deep fat fryer shall be such that it will be capable of raising the temperature of cotton seed oil, filling the cooking vessel to the normal cooking level, from room temperature to 300°F. above room temperature at an average rate of 8.86°F. per minute.

On this test the deep fat fryer raised the temperature of 2½" of cooking fat above the heating tubes from 85° to 385"F. in 15 minutes and 10 seconds or 19.8°F. per minute. This is more than twice as fast as the approved requirements of the American Standards Association.

Temperature of Heated Surfaces

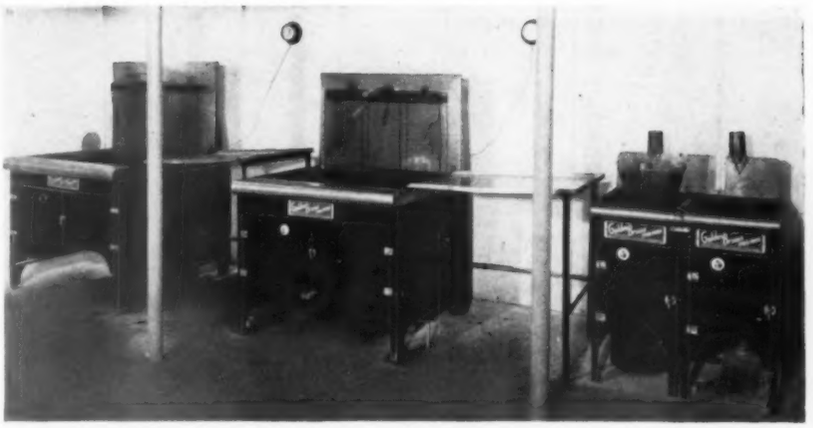
The highest temperature of heat exchangers in contact with the cooking oil shall not exceed the highest temperature of oil by more than 135°F.

This requirement is very important and has a direct bearing on the rate of fat break down. Temperature differences greater than 135°F. from the top temperatures used in deep fat frying tend to deposit carbon from the cooking fats or oils on to the heat exchangers. Numerous tests indicate a 25° to 50°F. lower surface temperature on the gas fired units compared to the electric elements. Such deposited carbon also accelerates corrosion of the heat exchangers, and lowers the heat transfer efficiency.

Temperature of Crumb Receptacle

The temperature one inch from the bottom of the crumb receptacle shall be at least 100°F. lower than the top temperature of the oil.

Crumb receptacle or cool zone temperatures obtained in the immersion tube gas fryer are approximately 75°F. cooler than obtains in the crumb receptacle of the electric fryer. High temperatures in this zone (350° to 375°F.), carbonizes or burns the food particles that fall into it. Such burned particles discolor the fat, and are the main source of black specks so often seen on fried foods.



Here is a typical gas fryer installation at Foster's Doughnut Shop, Lynn, Mass. The two fryers at the left, turn out 1000 dozen doughnuts daily. Wall type indicating thermometers consistently check thermostats.

A chemical and physical analysis of cooking oil before and after use in a heavy duty gas fired nut fryer, and in an equivalent size electric fryer, definitely favors the gas appliance. Approximately 900 pounds of various nuts were cooked in each fryer during a six-day period.

	GAS FRYER		ELECTRIC FRYER	
	Before using	After 6 days	Before using	After 6 days
Free fatty acid	.012%	.165%	.014%	.180%
Color intensity	6.6	111.3	6.6	169.0
Smoke point	426°F.	382°F.	432°F.	370°F.

Every criterion of fat breakdown indicates that the more rapid temperature changes in the electric fryer tend to increase the rate of decomposition of cooking fat.

The higher efficiencies now obtained in the gas fryer are changing the ratios of gas to electricity for this kind of work. Under continuous load, as evidenced by the evaporation of water test, 22.30 cu. ft. (corrected to standard conditions) of 535 Btu gas will evaporate seven pounds of water added at 74°F.

A modern equivalent size 7,000 watt electric fryer consumes 2.323 k.w.h. of electricity in evaporating 7 pounds of water added at 74°F.

The ratio of 535 Btu gas to electricity is thus 9.6 cu. ft. per k.w.h. for this kind of work under continuous load. However, in actual operation where the thermostats are calling for heat about 50% of the time and with burners or heating elements off 50% of the time, the following ratio obtains:

10.5 cu. ft. of 535 Btu manufactured gas equal 1 k.w.h.

This figure of 10.5 cu. ft. will vary more or less depending on the amount of food to be fried. A higher figure can be expected to obtain during quiet periods, while a lower figure approaching 9.6 cu. ft. per k.w.h. can be expected during the peak cooking periods.

On the basis of 10.5 cu. ft. of 535 Btu gas per k.w.h. we arrive at the following break-even costs of gas versus electricity in deep fat frying.

As noted below, natural gas at $.89 per M is competitive with ½ cent electricity, manufactured gas at $.95 per M with 1 cent electricity, and the socalled bottled or tank gas at 7.6 cents per pound can compete with 2

NATURAL GAS 1000 Btu per cu. ft. Cost per 1000 cu. ft	MANUFACTURED GAS 535 Btu per cu. ft. Cost per 1000 cu. ft	LIQUEFIED Petroleum Gas Cost per lb.	ELECTRICITY Cost per k.w.h.
$ .89	$ .48	1.9c	½c
1.34	.71	2.9c	3/4c
1.78	.95	3.8c	1c
3.56	1.90	7.6c	2c
5.34	2.86	11.5c	3c
7.11	3.81	15.3c	4c

Based on ratios of 5.62 cu. ft. natural gas and .262 pounds of L-P gas equivalent to 1 k.w.h.

cent electricity on a fuel-cost basis.

The same ratios and costs can also be applied as an all round average figure for hotel and restaurant cooking and water heating, provided steam tables and urns are temperature controlled, and the latest tvpe insulated ovens and water heaters are installed.

An interesting side light in connection with the deep fat fryer survey was, that in general the kitchens with gas fired immersion tube fryers were cleaner of deposits or condensed fat vapors than those using an electric appliance. This condition was particularly noticeable on the blades of the kitchen exhaust fan, and to a lesser degree on the walls, windows, and various objects. The obvious reasons for this are the closer temperature control, lower surface temperatures of the heat exchangers, resulting in less smoking fat, and products of combustion from the gas appliance apparently the products of combustion or flue gases in installations not directly flue connected (and few are) mixes with and dilutes the volatile and smoky fat vapors. This condition allows more of the vapors to be exhausted at the fan before they have a chance to condense.

Food Service for Defense Kitchens Featured at National Hotel Exposition

At the National Hotel Exposition, held at Grand Central Palace, New York City, November 10-14, the year's best opportunity was offered the gas industry to present the latest in gas-fueled food service equipment to leading hotel and restaurant men engaged in both civilian and national defense work. And, through the medium of an A.G.A. Combined Gas Exhibit, organized and sponsored by the Industrial and Commercial Gas Section of the American Gas Association, the part gas is playing in large-scale food preparation in national defense operations was highlighted—with no less than 44 up-to-the-minute gas units for commercial cooking on display in a single exhibit before many thousands of users or potential users.

The latest models shown by the manufacturers included: dry steam tables; deck ovens; open-top heavy-duty range sections; closed-top heavy-duty range sections; both uniform-heat-tops and center-fired hot-tops being included; fry tops; broilers; salamanders; range ovens; finishing ovens; cafe range sections; deep fat fryers; counter fryers; and doughnut fryers. In the attractive treatment of the high backwall, a color scheme and a use of the word GAS caught the attention of visitors from all over the first floor of Grand Central Palace. Through the large open space in the center of the building the gas backwall was also seen.

At right angles to the length of the display and covering 30 ft. of front end-wall was an American Gas Association panel, proclaiming gas an automatic, fast-heating, economical fuel. Six component panels in this area featured the virtues of gas for cooking, water heating, space heating, refrigeration, processing and manufacturing, and air conditioning.

Another feature of the National Hotel Exposition was a contest for the best recipe for barbecued meats and sauces, sponsored by the Societe Culinaire Philanthropique, with well-known chefs on the judging committee. In cooperation with the Societe, Masterchef Products, Inc., offered one of their Roto-Broilers as a prize.

An exhibit by the New York Food Trades Vocational High School attracted a continuous crowd, who watched the young cooks and bakers at work. On the job were a gas-fired deep fat fryer, confectionery stove, and an individually controlled deck bake oven. Eight hundred future cooks and bakers are trained yearly in this Board of Education project, particularly timely because of a shortage of cooks for national defense purposes.

The combined gas exhibit was planned by an A.G.A. committee composed of D. J. Brogan, J. J. Droescher, W. C. Guthrie, James F. Pitman, Charles A. Young, and Eugene D. Milener. In addition to the sales staffs of the exhibiting appliance manufacturers, composed of 40 men, representatives of the Industrial and Commercial Gas Section were on the floor at all times.

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TWIN BASKET MASTERFRYER
Other sizes from #10" Counter Model to 24" x 34" Doughnut Fryer

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- HIGH SPEED EFFICIENCY
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New Developments

Report of Sub-Committee of the Chemical Committee

By
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Eastern Gas & Fuel Associates,
Everett, Mass.

THE 1940-41 Chemical Committee Subcommittee on New Developments continued the work of previous years as follows:

1. To encourage the presentation of papers, particularly on new developments of a chemical nature.

2. To make a survey of new developments in, or relating to, the gas industry, and to compile topics, the physical and chemical aspects of which should be investigated by the Chemical Committee, government and educational agencies, and others. Personal letters were addressed to members of our association. Each letter requested information concerning altered, new, or prospective operations in the gas industry, asked for suggestions and ideas pertaining to related physical and/or chemical topics, made subsequent work more or less self-propagating by offering the continuous services of the subcommittee, and requested guidance on the work of compiling, correlating, and developing the important topics. Almost all the letters were answered with valuable ideas, suggestions, topics, and detail. This subcommittee and the industry are indebted to these men for their most generous cooperation. Excerpts from their letters and information secured under their guidance have been correlated and consolidated in this report.

Preparedness and National Defense

While preparedness and national defense are uppermost in all minds, our members emphasize that preparedness and defense are built upon a foundation of scientific, technical, and industrial development, and that in these respects our gas industry is making considerable progress. The natural gas industry especially is blazing new trails. A new plant at Cleveland, Ohio, liquefies natural gas in order to store it in a small volume, and then regasifies it for distribution as the need arises. Natural gas technologists have produced hundreds of valuable chemicals using natural gas as a raw material, and this has been described by J. B. Garner (4). Desiring similar developments in the manufactured gas industry, a few of our members suggest the sale of coke oven gas by a utility to a consumer who uses the gas as a raw material for chemical syntheses, not as fuel; that utilities handling coke oven gas might subject such gas to low temperature treatment whereby all components but hydrogen are liquefied, store the liquefied mixture, and sell the hydrogen as a raw material for chemical syntheses at a price considerably in excess of its fuel value. This seems important because it is just as necessary to make more nitric acid and more hydrogen available for national defense as to make more toluene available, and because existing coke-oven plants may be an important part of the hydrogen producing capacity of the nation.

Germany is said to be far ahead of any other country in the world in technical operations having to do with the coke-oven and gas industry. Many years ago they got the coke producers of the Ruhr district to pool their gas and separate it into fractions by refrigeration: and use the hydrogen for synthetic ammonia; use carbon monoxide and part of the hydrogen for oil production by the Fischer-Tropsch process, or for methanol production; use methane for acetylene and benzene syntheses; and finally concentrate the illuminants into a raw material fraction used for manufacture of glycol and other compounds having to do with Germany's national defense. In the last decade, pentaerithritol appears prominent in German explosives production, and this material obtained from acetaldehyde and formaldehyde is prepared essentially from water gas. The Bergius, Fischer-Tropsch, and Haber processes have greatly aided their efforts toward self-sufficiency. While these facts are well known, they are reiterated to emphasize the fact that very similar developments have not taken place either in the United States or in England.

Developments in the United States, however, are taking place in many directions. The Journal of Industrial and Engineering Chemistry staff review of the year 1940 outlines general progress and includes many developments in and relating to the gas industry (7). Of particular interest are the following: "No shortage of more than a minor nature developed in any manufactured product. . . . In 1940 the list of new products formerly imported but now made in this country is short, and the items composing it mean little. One finds significance not in the items included in the list, but rather in the omission of great numbers of products now no longer crucial because they have become part of our regular output. . . . New coal tar derivatives offered for the first time this year by Reilly Tar & Chemical Corporation include beta- and gamma-picolines, 2, 6—lutidine, fluorene, acenaphthene, and diphenylene oxide. Koppers Company is producing dicyclopentadiene, mono- and di — *tert* — butyl —*m*—cresols, alphapicoline, mixed picolines and lutidines, methylnaphthalenes, acenaphthene, fluorene, phenanthrene, and diphenylene oxide."

The correspondence received by this subcommittee shows that all activities are colored by the present crucial world situation, and that a great impetus is being given to all developments concerning new products, processes, and conditions affecting productive capacity and ability to meet the demands of the preparedness and defense program.

Industrial Research

New developments concerning the gas industry are mentioned also by William A. Hamor in his account of "Industrial Research in 1940" (5). Here we find:—"hydrogen reduction of ore to produce powdered iron is under development in California; the hydrogen is derived from natural gas. Ammonium thiocyanate is being produced at Everett, Mass., and potassium ferricyanide was marketed as Redsol Crystals. A group of refined high-boiling coal-tar solvents, known as the Cosols, were marketed. Notal is a toluene replacer. The Raschig process of phenol manufacture is in application in North Tonawanda, N. Y. Butyl-cresol compounds are being made industrially. Phthalic anhydride is expected to expand further in use; the recent commercial production of Monastral blues is an illustration of its utility.

** Chairman of Sub-Committee. Presented at Technical Section, Annual Meeting American Gas Association, Atlantic City, Oct. 20-22, 1941.*

Potential supplies of toluene used in the manufacture of TNT are considered adequate for all anticipated national requirements. Pyridine production was increased. Cetyl pyridinium chloride is a new germicide. A new chemical industry could be erected on further research on cyclanes (naphthenes). Certain tars from the low-temperature carbonization of coal possess fungicidal and insecticidal action.

"A number of developments have been made in distillate recovery in the natural gas industry. Diethylene glycol is being used to reduce the water content of natural gas in conjunction with propane refrigeration. Against the winter's peak demand, East Ohio will compress natural gas under 600-pound pressure, liquefy it by cooling at —250° C. and pour it into insulated spherical tanks, in which there will be the liquid equivalent of 150,000,000 cubic feet compressed to 0.06 its gaseous volume; heated by steam the liquid will again vaporize and go through East Ohio's mains.

"From 85-90 per cent of the synthetic resins are derived from coal. The world's output of synthetic resins, excluding cellulose and casein plastics, amounts to 150,000 tons yearly. Phenolics constitute about 30% of the production in this country. At present synthetic resins account for only a fraction of 1 per cent of the total weight of passenger motor cars, yet automotive manufacturers buy more plastics than any other industrial group.

"United Gas Improvement is operating a plant to produce styrene, butadiene, ethylene, isoprene, piperylene, cyclopentadiene (which is said to produce a resin suitable for lining food containers), and methyl styrene (reported to produce excellent varnish resins). Cyrene resins are modified polystyrene resins. Recent work on the control of the polymerization has made practical the production of styrene resins which are readily soluble in drying oils. Research has been accorded to various possible sources for monomeric styrene, either as a by-product from cracking processes or its direct production by synthetic means."

Our correspondents suggest further research: on the reactions of gaseous hydrocarbons at high pressure; on the phenomena of gas combustion and explosion; to study the explosive pressures created by the explosion of various concentrations of gas and air; to investigate the use of catalytic agents in the manufacture of water gas and coal gas remembering that catalytic agents are used successfully in modern oil refineries; to investigate substitutes for materials which are now imported for use in the gas industry,—yarn for pipe joints, tin for meters, leather for diaphragms. Attention is called to the great quantities of scale formed during rolling and other operations in the steel industry, and to the possibility of reduction of this scale using gas before or after some reforming.

The study is suggested of hydroxy carboxylic acids from bituminous coal and preparation of solutions further to develop processes intended to separate mineral matter and carbonaceous matter; it seems that the carbonaceous matter thus obtained can be used in the production of colloidal fuel, carbon black, active carbon, and plastics.

A stimulus was received from a prominent research and development director in the chemical industry. He writes that "from the standpoint of the chemical manufacturer, the criticism of most gas and coke operations is that they do not know what they have. Mixtures are sold of certain physical characteristics, but any attempt to get anything definite about the chemical nature of the material usually brings you up against a stone wall. It may be that these by-products are too unimportant or too complex. You will note, however, that the petroleum industry which used to be that way, has become more and more chemically conscious. We can very rarely start anything from a mixture. This matter of producing chemical individuals rather than hodgepodges is the one thing that occurs to me at the moment with regard to our industry."

Coal and Coke

Events during 1940 directed attention to problems of coal storage. In some plants the coal stock piles are not turned over or replaced every year, but are held until such time as required due to frozen rivers, high water or strikes. Some parts of some storage piles have been in storage for as long as ten years. One plant has used the layer method of storing coal continuously since 1922, finds it superior to the customary method previously used and reports—no coal loss or labor expense due to fires, less volatile and Btu. losses, lower temperatures and therefore less deterioration in gas coals, capacity per cubic foot is increased about one third, while cost of leveling and rolling layers is 1.2c per net ton. In this plant the coal is stocked by distributing with ore bridge a layer of run-of-mine coal about three feet in depth, and this is levelled with a drag made of three ninety-pound rails about six feet long; the rails are spaced thirty inches apart and a four-ton roller is hauled over the loosely packed coal until the layer becomes firm. In this way the pile is built up to a height of about fifty feet, and storage capacity is increased about 20%. After three years of such storage there is found little loss of volatile matter or by-products, and little if any adverse effect on coke produced.

Opinion is expressed that there should be adopted some standard method for the measurement of stresses and strains developed during carbonization. Several methods have been described and failure to select any one for general use seems due to the fact that new and valuable modifications have appeared in rapid succession. While the gas industry has largely overlooked the thermodynamic approach to this problem, some work in this connection has been undertaken by educational institutions (3). Mechanism of carbonization concepts thus are being correlated with ideas concerning the interdependence of pressure-volume-temperature-time-composition characteristics of the coking charge. Other workers are investigating various aspects of the behavior of coals during carbonization, e.g., controlling plasticity of the oven charge (by blending or pretreatment of coal) to control the process of carbonization and the factors responsible for coal expansion. Of interest in this connection is a reference that "by the Hodsman method the swelling of coal during carbonization is controlled by the addition of inorganic salts" (6).

Other suggestions concerning carbonizing coal in an atmosphere of hydrogen are: Gasifying oil in an atmosphere of hydrogen or blue gas gives about 25% higher efficiency of oil cracking from a gas-making standpoint, and this would indicate that carbonizing coal in such an atmosphere will result in the recovery of more hydrocarbons as permanent gases. A study of the so-called mineral constituents of coals, fusain, vitrain, durain, etc., seems important as an aid in determining the coking characteristics of coals.

Carbonization of Coal-Oil Mixtures was described by Ramsburg and McGurl: Economics, yields and quality of products are attractive; increase in bulk density of the coal mix charged to ovens increases or maintains, under all conditions, a high thru-put. In one plant the increase

in thru-put due to oil addition was found to be about 7%.

Automatic Coke Stokers: "Completely automatic stokers which take coke from the bin and put it into the fire box, shake the grates, and remove ashes from the ash pit into ash receptacles are available for use with coke. While these are more expensive than units which simply feed coke, they are as completely automatic as any other form of automatic house heating equipment. Thus "coke finds its place in the fuel market in any situation from handfiring to completely automatic operation" (12).

Dustproofing coke was mentioned: some plants do not use a test for dustiness of coke, and depend upon customers' reaction to indicate the efficacy of various treatments. There would be much interest in the experiences of different plants. One plant reports much corrosion difficulty from using calcium chloride. Further investigation was indicated concerning the evaluation of oils used in dustproofing; development of satisfactory methods of testing; small scale testing by applying the dustproofing medium with a hand spray versus application with a pilot-plant type of apparatus.

By-Products—Old and New

A consensus of opinion is "that the development of a by-product industry just naturally is bound to work toward lower costs for gas, and that in this day and time of rapid development and sale of competitive products, research must be undertaken to ascertain all the possibilities which may exist" (9). Consequently, we all should carefully consider how practical it would be to operate supplementary processes designed to increase the yield of old by-products, to get new by-products, and to use coal, coal tar, oil-gas, water gas tar, etc., as chemical raw materials—by hydrogenation, catalysis, low temperature carbonization, and otherwise.

With reference to by-products, workers suggested: study of crystal size and formation in saturated solutions of ammonium sulphate in 2-4% sulphuric acid; study of different methods of removing and recovering hydrocyanic acid; the production of ammonium thiocyanate and sodium ferrocyanide from manufactured gas; isolation of pure chemicals from tar, and from light oil with emphasis upon the lighter and heavier ends; continuous pyridine recovery; recovery of compounds such as butadiene, cyclopentadiene, styrene, and indene; further development of processes for the production of ammonium sulphate, or some ammonium salt from the sulphur available in the gas; consider the advisability of increasing the domestic supply of creosote oil in the event that foreign sources are cut off since a larger domestic output would probably involve a change in existent tar distillation procedure. A similar comment is made regarding cresylic acid and napthalene.

Following the erection and operation of new installations, information was requested on the recovery of hydrocyanic acid from gas by the thiocyanate process, and on the production of dry-wettable, and dry-dusting sulphur by the Thylox liquid purification process.

Although potential supplies of toluene are considered adequate for all probable requirements (5), there is keen interest in light oil and light oil products as the source of new by-products, and of inhibited motor benzol of exceptionally high octane rating. One correspondent considers forerunnings from two aspects, namely what saleable products can be removed profitably, or how they can be left in the gas and not diverted as impurities in the desired light oil products. "Sulfonation has been applied as a control test for the purity of toluol by many slightly different techniques, the details of which have been varied to meet the specialized needs of the technicians. . . . First-class toluol gives a sulfonation mixture which is brilliantly clear and leaves no unsulfonatable residue. Second-class toluol may show .02 to .25%. Third-class toluol will show from .25 to 1.0%. The appearance of the sulfonated mass is an indication of the desirabiilty of the toluol sample. First-class toluol yields solutions with a greenish shade of yellow somewhat akin to a French olive oil in color. Off-grade toluol, that is, a product of the second or third class, may yield yellows admixed with iridescent tints of violet (10)."

There is considerable interest in production of inhibited motor benzol. It is emphasized that "the tendency in motor fuels is toward the production of single hydrocarbons or a group of three or four in order that the combustion in automotive engines may be precisely controlled. Octane rating motor fuels of 100 and over are produced for aviation use, and these products may be utilized in pleasure cars within five years. Sulphur compounds decrease octane numbers as well as lead susceptibility. Hydrocarbons whose octane ratings are at least 125 are often thought of as the ultimate in motor fuel possibilities. It has been contended, however, that the only value of the octane number is for control and investigational purposes—that gasoline quality should be measured by practical performance rather than laboratory tests. Aqueous caustic solutions containing certain organic compounds ("solutizers") are claimed to be superior to straight caustic solutions for the removal of mercaptan from gasolenes. At least 10 petroleum refineries are using bauxite for bleaching paraffinic oils. Florite, Porocel, and X-Yte are activated bauxites (5), and it was suggested that these might be found useful in motor benzol production operations.

Gas Production, Purification and Distribution

55% more gas was used in 1940 than in 1939, and it was estimated that a further increase will be required to fill the growing needs of the defense program. This has involved replacement of old equipment with new modern facilities, and has led to utilization of recently developed processes designed to increase the yield of gas. For instance, by adding oil to coal, there is a marked increase in the tons of coal carbonized per day in the same plant operating with the same coking time and the same labor force; and by utilizing modern gas mixing controls it is practical now to use gases from coke ovens, producers, water gas generators, refineries, and natural gas sources, mixing these in suitable proportions with or without air to make a mixed gas that is interchangeable with the base fuel. Gas thus produced is being used industrially notwithstanding the inevitable compromise made to get the desired combination among composition of gas and products of combustion, velocity, flame temperature, radiation, and other flame characteristics. Thus the industry's attention is called to new developments concerning an old problem, namely, "the question of mixing various gases in varying proportions, with the mixture still retaining sufficiently uniform characteristics to permit its utilization in all types of appliances. This problem does not involve only substitute gases for replacing or augmenting the supply of natural gas, but includes among other phases the question of coal gas and carburetted water gas mixtures. Once the forthcoming Defense Program is under way, it is certain that many communities will be called upon to supply gas in quantities exceeding the capacity of their coal gas plants, and it will be necessary to augment their supply with other forms of gas--principally car-

buretted water gas. While it has long been the practice to handle peak loads of coal gas plants by the use of carburetted water gas, it has generally been found necessary to limit the proportion of carburetted water gas to some degree. With the increase in gas business, it may be necessary to make mixtures containing up to 50%, or even more water gas at times; and from past experience, it is indicated that many companies will experience utilization difficulties. It may be found possible, however, by varying the quality of the carburetted water gas, to perhaps minimize such difficulties, and it may be that a real study along such lines may produce beneficial results." Mixing different gases to give a uniform product—or rather to give uniform results at all times—indeed is an important problem. While the industry has done much work on this problem, much still remains to be done. Members suggest continued study of ways and means for maintaining uniform specific gravity and flame characteristics when utilizing varying mixtures of water gas and coal gas; and suggest that perhaps a schedule of pressures could be established which could be used with certain gravities of gas with which the customer would get satisfactory service.

Suggestions were made that the gas industry should study and develop processes to reduce the cost of producing coal gas, and reduce large investments now required; reference was made to a continuous gas manufacturing process and to use of special high temperature resisting metals and alloys. Unit processes in chemical engineering of interest to the gas industry, a subject started in 1933, should be brought up to date. Air-steam ratios in water gas operation deserve more attention. While an extensive investigation of this was made by the Institution of Gas Engineers, the results cannot be applied in the United States because our practice is quite different from that in England. Heavy oil cracking with special reference to increasing the yield of oil gas per gallon of oil, and methods of increasing tar and light oil yield in production of carburetted blue gas, seem promising avenues of investigation.

Workers suggest that consideration be given to the following: to the effect of various kinds of water on the tanks used in gas-fired water heaters to determine the proper corrosion-resistant metals to use; to development of a gas odorant that does not contain sulphur or other inherently undesirable constituents; to a combustion promoter, or combustion catalyst, in the form of paint or other medium that can be applied to pilot tips or gas burners to promote spontaneous ignition when raw gas comes in contact with the atmosphere, and thus eliminate pilot lights and matches; to investigation of effect of passage through soil on composition of gas, as a means of assisting leakage investigations when the source of gas is in doubt. In the same connection, to develop a harmless chemical that can be injected into gas, which will not be removed by passage through soil, and can be readily identified by simple analytical means, so that the source of leakage may be identified.

Anent the effect of gas quality on customer complaints, it is felt when the work is broken down into its component parts such as nitric oxide, permissible gas gravity, Btu., and pressure variations, oil fogging for dust control, etc., that we are merely applying known techniques which have been more or less fully described before the association. One opinion was expressed that "the growth of modern appliance design and the development of automatic appliances demand rigid standards of quality in gas manufacture; and it appears that information now available on the control of nitric oxide and specific gravity, Btu., use of the oil fogger, records of customer complaints, and other diseases of the distribution system is very unsatisfactory." While it is true that filters will remove some materials which clog pilots, the filters themselves will eventually become clogged. To supply filters on the many constant-burning pilots in service would be very costly. One member emphasizes that unless our utilities eliminate the components and conditions which cause clogging, we must expect continuous servicing of pilots.

Concerning nitric oxide, it was suggested that the necessary apparatus and technique for the determination of nitric oxide in the raw gas at the coke ovens is definitely new and worthy of description. A comparison of the Shaw Method with that proposed by Guyer and Weber and described also by Hollings was proposed. Attention was given also to minimizing NO concentration by suitable adjustments in plant operation; to determination of NO by analysis of small snap samples in an effort to further develop the method of Tropsch; and to the study of factors influencing the modified Shaw method. It was emphasized that nitrogen oxides produced on combustion of various types of utility gases will become increasingly important in connection with the use of gas for producing inert atmospheres, corrosion of materials used in flues, ovens and other appliances, fading of textile and other colors, degradation of meat, physiological action on humans, and significance in metallurgical heat treatment.

Anent gas purification, members suggest getting a comparison of scrubbing mediums:—sodium carbonate, tri-potassium phosphate, phenolate, aliphatic amines, and strong inorganic bases combined with weak organic non-volatile acids (amine-sulfoacids and aminocarbonic acids). Reference is made to the latter in the Alkacid plants operating in Germany and elsewhere for the removal of H_2S and CO_2. Phenolate-type plants, after two years' commercial operation, are processing about 55 million cubic feet of gas per day and have a sulfur-production capacity of 26,000 tons per year equivalent to 75,000 tons of 66° Be′ acid. In some cases, particularly in the treatment of natural gas, it is necessary simultaneously to remove water and this is being done by using diethylene glycol.

Instrumentation and Process Control

Recent developments have produced new instruments and machines and better methods of manual and automatic process control. During 1940 Müller (8) presented a comprehensive report on progress in instruments and improvements in instrumentation. While this deals primarily with instruments of importance to the chemist, a magnificent impression is given of the American instrument and apparatus industry. Communications to this subcommittee showed interest in the further development of physical and chemical control and instrumentation for the gas industry. Our members voice the need for an H_2S recorder, rugged and simple in operation, which could be profitably used in purification processes; for an instrument to record the light oil content of gas; for a record of the various important impurities other than H_2S in gas; and for a more precise yet simple recorder showing specific gravity of gas.

PAPERS

The 1940-1941 Subcommittee on New Developments arranged for the presentation of the following papers:

1. "How Recent Developments of Water Conditioning Technique Are Combatting Industrial Water Problems," by R. E. Hall, Director, Hall Laboratories, Inc.
2. "Developments in Foundry Coke and Foundry Practice," by D. J. Reese, The International Nickel Co., Inc., New York, N. Y.
3. "Investigations Concerning the Pressures Developed During Carbonization of Coal," by Walter Fuchs, A. W. Gauger, A. G. Sandhoff, and J. A. Taylor, The Pennsylvania State College, State College, Pennsylvania.

(Continued on page 54)

News of the Gas Industry

MEMBERS OF DOMESTIC RANGE COMMITTEE IN CONFERENCE

Left to right around the table: Lucian L. Kahn, Estate Stove Co., Hamilton, Ohio; J. E. Kern, Southern California Gas Co., Los Angeles; Malcolm Leach, Glenwood Range Co., Taunton, Mass.; W. L. Hayes, Montana-Dakota Utilities Co., Minneapolis; R. S. Agee and H. S. Minster, Roberts Mander Stove Co., Hatboro, Pa.; John Bogan, Assoc. of Gas Appliance & Equipment Mfrs., N. Y. C.; B. R. Tritton, American Stove Company, Cleveland; Stanley C. Little, American Stove Company, Cleveland; James P. Hanlan, Public Service Electric & Gas Co., Newark, N. J.; Lloyd Ginn, American Stove Company, Cleveland; Wallace M. Chamberlain, Incoming Chairman, Michigan Cons. Gas Co., Grand Rapids, Mich.; George L. Scofield, Chairman, Republic Light, Heat & Power Co., Buffalo; F. W. Williams, Assistant Secretary, Residential Section, A. G. A.: W. E. Derwent, Pres., A.G.A.E.M., Rockford, Illinois; George D. Wells, The Gas Service Company, Topeka, Kans.; Cy Young, The Gas Service Company, Kansas City, Mo.; C. F. Henness, Public Service Co. of Northern Ill., Chicago; W. M. Kramer, Philadelphia Electric Co.; Fred A. Kaiser, Detroit Michigan Stove Co., Detroit; W. E. Bolte, The Brooklyn Union Gas Co., Brooklyn, N. Y.; W. H. Van Riper. Cribben & Sexton Co., Chicago.

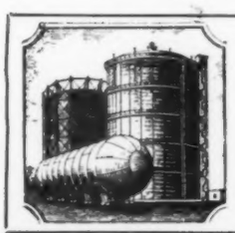
Present but not in photograph:—H. Vinton Potter, Fall River Gas Co., Fall River, Mass.; E. G. Peabody, Citizens Gas & Coke Utility, Indianapolis; Allan Tappan, The Tappan Stove Co., Mansfield, Ohio; R. J. Vandergriff, The Laclede Gas Light Co., St. Louis.

Range Committee Plans To Continue CP Promotion During 1941-42

The Domestic Range Committee, composed jointly of gas utility men and Certified Performance Range Manufacturers, held its first meeting for the new Association year under the Chairmanship of Wallace M. Chamberlain, Grand Rapids, Michigan, at Atlantic City, October 19. There was full attendance of the membership of the Committee and, in addition, many state managers of the CP Range Program were present.

In making its plans for the promotion of CP Ranges during 1941-42, the committee had the support of the gas utility and manufacturing branches of the industry to an unusual extent. First was the resolution of the American Gas Association Executive Conference that "every gas utility, the American Gas Association, and the Association of Gas Appliance and Equipment Manufacturers should continue unabated their promotion of Certified Performance range sales, as representing the ultimate in modern cooking equipment." Second, the pledge of the Certified Performance gas range manufacturers that they "are determined to utilize every means and resource at their command to continue CP production in undiminished and satisfying quantity, in so far as consistent with the country's gigantic defense effort."

Each utility member of the committee serves as a regional manager in one of the eight geographical regions of the United States and has appointed a CP promotional manager for each state in his region. Plans are now being made for closer cooperation between state and regional managers during the coming year. One of the features of the 1942 program will be the presentation to the industry of four complete CP range sales campaigns especially designed to meet the local conditions of gas companies in various parts of the United States. These campaigns will be presented by the field representatives of A.G.A.E.M. and it is thought that this material will answer a long felt need for packaged CP range promotional programs. It was unanimously decided that the CP Ranger Club should be continued during the coming year.



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Laclede Gas Files Reorganization Plan with P.S.C. & S.E.C.

A comprehensive plan of reorganization effecting a simplification of the capital structure of The Laclede Gas Light Company and providing a method of integration of the gas and electric properties in the St. Louis area and for a sale of control of the reorganized Laclede Gas Light Company to residents of Missouri was filed September 4 by President L. Wade Childress with the Securities and Exchange Commission at Washington and with the Missouri Public Service Commission at Jefferson City.

The plan, subject to approval of these two commissions, provides that the reorganized company operating under the name of Laclede Gas Company, with the present Board of Directors, mostly St. Louisans, proposes to take over for an integrated operation with its present system, the properties now owned by St. Louis County Gas Company following readjustments of Laclede's financial structure.

Laclede Power & Light Company's electrical division has evidenced its intent to meet the purposes of the integration sections of the National Public Utility Holding Company Act by joining with the Laclede Gas Light Company in signing the plan and thereby committing itself to the principle of the Holding Company Act, that the electric properties in the St. Louis area should be operated entirely apart from gas company ownership, and as a part of a unified electric system.

Ogden Corporation, at present the owner of the majority of stock of both the Laclede Gas Light Company and Laclede Power & Light Company, also by signing has committed itself to the plan including the provision that following the reorganization, its holdings of Common Stock of Laclede Gas Company will be offered for sale to residents of the State of Missouri at a price to be approved by the Securities and Exchange Commission.

SERVEL REFRIGERATOR PRODUCTION REACHES TWO MILLION MARK

Louis Ruthenburg, president of Servel, Inc., Evansville, Indiana, receives congratulations from F. B. Culley, president of the Evansville Chamber of Commerce on the 2,000,000th Servel Electrolux refrigerator. Present in the picture are officers and directors of the Chamber of Commerce, including left to right, seated: Victor Goeke, Clarence B. Kahn, L. A. Parker, C. B. Enlow, Henry Bohnsack, Mayor William H. Dress; standing, A. P. Eberlin, Rudolph Meyer, William Schear, A. J. Hoffman, Fred Fischer, Harry Fitzgerald, F. B. Culley, Louis Ruthenburg, Ralph Kleymeyer, Ray A. Miller, H. B. Sourland, Glen L. Ogle and W. E. Baker.

1942 Servel Electrolux Models Keynote Beauty—Flexibility

The 1942 Servel Electrolux refrigerators feature a still more attractive, simplified exterior design, and retention of all the modern, improved features inaugurated last year to meet every food storage problem of the modern housewife.

Maximum flexibility of storage space, increased ice cube capacity, faster freezing of ice cubes and more easily removed ice cube trays, are among the convenience features retained in the new line of gas refrigerators.

Outstanding features retained in this year's models are: Tilt shelves next to the freezing unit providing extra storage space for small containers and, when tilted back, extra storage space for unusually tall bottles; the three-position, and the two-position sliding shelves; faster freezing; increasing ice cube storage space; a trigger release for ice cube trays.

Also retained in the new models are the "dew-drop" vegetable fresheners, controlled humidity for meats, and interchangeable porcelain storage trays.

Bulletin on Clark Steam Driven "Angle"

Clark Bros. Co., Olean, New York, have announced that a bulletin is now ready for distribution on the new Clark "Angle" Steam Engine Driven Compressor. Clark Bros. will be glad to send this bulletin, No. 200-73, to engineers and others desiring it. Requests should be sent to the company's home office.

Roper Now Building New Defense Plant

In order to cooperate fully with our National Government the Geo. D. Roper Corporation, Rockford, Illinois, is now building a new $500,000 plant. This plant is being built for the manufacturer of 75 millimeter Armor Piercing Shot for the United States Army. (A 75 millimeter shot is approximately 3" in diameter, 9" long, and weights about 14 pounds.) About 300 people will be employed in this new defense plant.

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2" HANDLE & LOCKING SLEEVE
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CEDAR RAPIDS, IOWA

Valve and Meter Representatives Meet in San Francisco

Following the official sessions of The American Petroleum Institute, held in San Francisco recently, more than a score of officials and representatives of Merco Nordstrom Valve Company and Pittsburgh Equitable Meter Company met for the discussion of 1942 activities. They reported from various parts of the country. Colonel W. F. Rockwell discussed policies of the two companies and conditions confronting the organization, priority situations and plans for immediate expansion. Studies of production facilities were made at the Oakland plant of the companies, where several hundreds of visitors at the A.P.I. Convention were guests during the days immediately preceding.

The majority of valve and meter representatives are shown in the accompanying photograph taken at the Mark Hopkins in San Francisco.

Officials and representatives at San Francisco meeting.

Goth Becomes Government Heating Engineer

Mr. Carl A. Goth, gas heating sales engineer with the Iowa City Light and Power Company, Iowa City, Iowa, since 1938, has resigned to accept the position of heating engineer with the United States Government, with headquarters at Omaha, Nebraska. Mr. Goth will be a civilian employee.

He came to the Iowa City Company, from Waterloo, Iowa, where he was air conditioning and heating engineer with Adams Wholesalers. Previously he had been employed as heating sales engineer by the Iowa-Nebraska Light and Power Company at Lincoln, Nebraska. Mr. Goth is a graduate mechanical engineer of the University of Nebraska.

EMCO Executives Called for Military Service

Three executives of the Pittsburgh Equitable Meter Company have recently been called for active military duty in different branches of the service.

Colonel W. F. Rockwell, President of the company, was called for extended active service early in October, reporting to Washington, D. C., where he has been serving as Assistant to the Chief of the Motor Transport Division.

Col. W. F. Rockwell

Captain A. E. Higgins, Vice President of the company, originally called in midsummer for active duty in the Air Corps, has been temporarily deferred due to certain National Defense activities in which the Pittsburgh firm is engaged.

For the past eight months, Captain J. R. Sproat of the Sales Staff has been serving with the 176th Field Artillery in command of Battery "F" at Fort Meade.

Reappointed Chairman of Rate Committee

C. L. Follmer, manager of the rate research department of the Consolidated Electric Light and Power Company of Baltimore, Baltimore, Md., has been reappointed chairman of the Rate Committee of the American Gas Association for the term, 1941-42. During Mr. Follmer's previous chairmanship, the Rate Committee, whose function it is to study all phases of rates and rate-making, considered chiefly problems arising from the present national emergency. Because of the continuing nature of these problems and Mr. Follmer's excellent record as chairman for the past year, President Hawley decided that his duties as head of this committee should be uninterrupted, thus assuring continuation of activities already commenced.

Since 1924, Mr. Follmer has been associated with the Consolidated Gas Electric Light and Power Company of Baltimore —first as assistant to the electrical engineer engaged in the design of the Holtwood (Pennsylvania) and Gould Street (Baltimore) power plants; then two years as assistant purchasing agent, several years as technical assistant to the president, and, since January, 1938, as manager of the rate research department.

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Improving and Controlling Forced Warm Air Installation Practices

By
H. P. Morehouse
Metropolitan Heating & Air Conditioning Council

With the growing acceptance of forced warm air heating, installation practices have become more chaotic. Some utilities have found it necessary to control these practices in order to relieve themselves of excessive service complaints.

In some areas installation practices had become so unorthodox and unsatisfactory that gas winter air conditioning as a system for heating was coming into disrepute.

A few of these systems of control have been in operation long enough so that their practical result could be observed. Profiting by these experiences the Metropolitan Gas Heating & Air Conditioning Council prepared a complete program for the control of installation practices in both the speculative and contract building field.

The plan, which was designed to be used in the Metropolitan New York Area, has now been approved by the American Gas Association, and any utility who wishes can make use of it.

There are two possible ways of controlling installation practices. One is a long range program to educate the public and the builder to maintain high standards. This program may be said to start from the top and work down. It will have its greatest effectiveness with contract housing where "quality" and "comfort" arguments find a responsive audience.

The other program may be said to start from the bottom and work up. It probably has more immediate effect and, further, has the advantage of being effective in both the speculative and contract market.

Briefly, the plan consists of the following tools:

The Gasco Installation Guide
The Gasco Standard Form Architects Specifications
The Gasco Code of Minimum Requirements
The Gasco Short Form Architects Specifications

The Gasco Installation Guide of Recommended Practices for Installation of Gas Winter Air Conditioning in New Homes has just been revised. (See illustration). This Guide is really a text representing the working standards as practiced by a number of gas companies throughout the country. It was designed to be used in contract housing where the home owner and the architect wanted the best possible installation.

To quote from the Foreword in the Guide "The following recommendations are intended as a guide for proper and adequate installation of gas winter air conditioning systems for new homes and should not be construed as a code of minimum requirements. The recommendations of such recognized authorities as the American Society of Heating & Ventilating Engineers, the National Warm Air Heating and Air Conditioning Association and the National Board of Fire Underwriters, have been used as a basis for preparing this Guide."

To arrange the recommendations of the Guide in a more readily usable form the material was transcribed into the language of the architect. It was printed loose leaf and arranged like an architect's specification. As a matter of fact the typography was made to conform exactly to that of the General Specifications of the American Institute of Architects. A colored cover (see illustration) is placed around each set of specifications and on the cover is printed the instruction to architects as to how they may use the material. It is arranged in such a way that it may be incorporated directly into the architect's regular set of general specifications simply by typing in certain information such as number, make and size of unit, or the pages may be used as scratch sheets which he can use as his rough copy to be corrected and passed over to his typist. In either case the gas company may be sure that the installation is planned according to the rules of best practice.

In most areas the contract houses are very much in the minority, and while it would be an ideal situation if speculation houses would use practices recommended in the Guide it is not logical to expect such support from the builders.

There are certain practices which are desirable and are worth the extra costs to those who want the best. Some of these practices, however, are not absolutely essential and fairly satisfactory operation may be had if they are omitted. There are other standards which absolutely *must* be maintained if reasonable comfort and satisfaction are to result. These *must* practices are incorporated into the Gasco Code of Minimum Requirements. It incorporates standards below which the gas company takes no responsibility for good heating service.

Conformance to this Minimum Code might be enforced several ways: Delay in setting meter if a hazard is involved, notification to builder or home owner that the installer is making a substandard job, refusal to give regular periodic service to installations which are sub-standard, where charges are made for service a higher rate might be charged for substandard installation, etc. In general some real penalty must be imposed in order to get adherence to the minimum standards.

Experience of companies using the Minimum Code has been excellent. Standards have been raised without any permanent sacrifice in customer or builder relations. Most installers and builders welcome the control because it lessens their heating complaints and puts all bidders on the same basis. It eliminates the practice of each bidder trying to outdo the other in cutting corners in order to get the order.

The fourth control tool is the Gasco Short Form Architects Specifications. This set of specifications is based on the Gasco Code of Minimum Requirements and follows the form and typography already mentioned under the "Standard" form. This Short Form can be used where an architect draws plans for speculative houses, or even in some contract houses where the owner does not wish to pay the extra cost for an installation which meets best practice in all respects.

The proposed use of this material by some of the gas companies in the Metropolitan New York Area is to see that each architect, builder, manufacturer, dealer and sheet metal installer has copies of the Gasco Guide and the Gasco Code of Minimum Requirements. Next step is to see that each architect is made acquainted with the "Standard" and "Short" forms of specifications. The architects will be furnished, gratis, sets of these specifications in limited quantity for their current use.

The Standard and Short forms of specifications and the Code of Minimum Requirements cost the gas company 5c each, and the Guide costs 7½c each. This is certainly small insurance to pay for getting a good installation on the lines and one that will not require a lot of extra service later because of customer's heating complaints. It also offers an opportunity to improve architect relations because it will be a real service to a large percentage of architects.

Copies of the control tools mentioned may be obtained from the American Gas Association. Every gas company which is having trouble with winter air conditioning installation practices should find some ideas in this material that will help it control the installation problem.

Refrigeration Equipment Manufacturers Association

Voting down a suggestion to suspend the fourth All-Industry Refrigeration and Air Conditioning Exhibition, the Board of Directors of the Refrigeration Equipment Manufacturers Association has announced definitely that the show will be held in the Stevens Hotel, Chicago, Jan. 12-15 inclusive.

Quoting President Roosevelt's recent statement that, "Wherever people congregate, the story of defense must be presented," the board announced that the coming exhibition would show the industry's part both in military defense and in civilian defense.

The directors recognized that the need for bringing together in one place at one time everyone of importance in the industry was greater now than ever before.

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Air Conditioning System

(Continued from page 23)

resenting a 15 degree differential with outside temperature. The heating system is designed to maintain 70 degrees against 30 outside.

The method of installing the air conditioning equipment is unique in that the entire installation is "sales slanted." The refrigeration units have been set up to facilitate their use as demonstrators. Wherever possible, piping is mounted in the open so that prospective customers may view construction in detail. This policy has been carried out most effectively by installing one of the four refrigeration units on the first floor of the new building. The Williams Air-O-Matic unit stands in full view in a corner of the salesroom of the Merchandise Section. Mounted on a six-inch concrete base, it has been set far enough from the walls to permit visitor to inspect it from all sides.

Sweatt Becomes Member of O.P.M. Advisory Committee

H. W. Sweatt, President of Minneapolis-Honeywell Regulator Company, was named a member of the Plumbing and Heating Industry Defense Advisory Committee of O.P.M., it has been announced by O.P.M. in Washington.

Southwestern Gas Measurement Short Course

The 1942 meeting of the Southwestern Gas Measurement Short Course will be held at the University of Oklahoma, Norman, Okla., on April 14-16. These dates are announced well in advance so as to avoid conflict with any other meetings of gas men. Kate A. Niblack is chairman of the Publicity and Registration General Committee. Address, Biltmore Hotel, Oklahoma City, Okla.

Meter Priorities

Some gas companies have been delayed in securing deliveries of orders for gas meters. It has been suggested that perhaps some of them are not fully aware that public utility meters are classified as National Defense supplies under rating A-10 for maintenance, repairs and operations. In an order for meters the gas company simply writes or stamps across the face of the purchase order the endorsement as provided in order P-46, no certificate number being required. The meter manufacturer replenishes his stock by assembling all the orders he has filled and presenting them in proper form to the Defense Supplies Rating Group and receives an allocation of critical materials in the same volume. Meters are also included in the blanket preference rating for defense housing. They are not included for new construction since it is the evident purpose in Washington to suspend all new construction for the emergency except that considered essential to the National Defense.—*A.G.A.*

Bolton Appointed District Manager

The appointment of Mr. E. C. Bolton as manager of the Cincinnati District Sales Office is announced by Cutler-Hammer, Inc.

Mr. Bolton has been with the company since his graduation from Carnegie Institute of Technology in 1922. In 1925, after three years in the Engineering and Sales Departments, he took over Public Utility sales in the Chicago District. Shortly afterwards, his territory was expanded to include the entire Middle West and in 1935 to include the whole country.

A native of West Virginia, Mr. Bolton has had his headquarters in Chicago for the past sixteen years.

CONVENTION CALENDAR

February

9-11 *Southern Gas Association and A.G.A. Southern-Southwestern Gas Sales Conference,* Biltmore Hotel, Atlanta, Ga.

March

19-20 *New England Gas Association,* Annual Convention, Hotel Statler, Boston, Mass.

Alternative and Auxiliary Gases

(Continued from page 28)

gas in the plant system. Additional blue gas machines would then be fired up and operated to crack oil to a 650 Btu. oil-gas which would then be cold enriched by additional butane up to the 800 Btu. standard. Although the use of butane is recognized as being more expensive than high Btu. oil-gas, the advantages of convenience and flexibility outweigh such considerations.

In the case of the Public Service Company of Indiana, the LP-Gases are cracked in the standard three-shell water gas set using the Steinwedell process for a production of a substitute gas for natural gas. This process produces a gas of about .65 specific gravity and 970 Btu. If this is used 100% in place of the natural gas, there is a tendency for a few types of burners to pop back when previously adjusted on natural gas. In actual practice, this company has, on several occasions, used the substitute gas in amounts up to about 70% of the gas being distributed.

Table V summarizes the reports of companies who use LP-Gas in the manner indicated by the classification in this section.

Enriching Manufactured Gas

Both economic and technical reasons have limited the use of LP-Gases as enriching agents or as standby gases for straight manufactured gas companies. Mixed Gas Research Report No. 645 of the American Gas Association discusses in considerable detail the limits of mixing various gases, and the following has been extracted therefrom.

"The American Gas Association Testing Laboratories ran a series of tests from August, 1929 to January, 1932 to find out the suitability of various butane gas mixtures for supplementing existing gas supplies. This work has already been referred to previously in this report in connection with natural gas replacement where wide latitude in the use of butane has been demonstrated in actual field practice.

"In the case of manufactured gases, much narrow limits of usefulness exist because of the difference in heating value, chemical composition, and specific gravity of butane compared to the usual manufactured gas. In order to utilize butane successfully, it is necessary to mix it with blue gas, producer gas or air so as to balance these factors."

TABLE VI
PERMISSIBLE AMOUNTS OF LP SUBSTITUTE GASES

No.	Substitute Gas Composition	Sp. Gr.	Maximum Allowable Amount of Substitute Gas, Per Cent of Original Gas	Specific Gravity of Mixture
	Appliances Originally Adjusted on Coke Oven Gas, 550 B.t.u. Sp. Gr. .42			
1	8.6% Butane + 91.4% Blue	.73	20%	.47
2	13.5% Butane + 86.5% Producer	1.05	10%	.47
3	17.2% Butane + 82.8% Air	1.11	10%	.48
	Appliances Originally Adjusted on Carburetted Water Gas, 550 B.t.u. Sp. Gr. .64			
1	As Above	.73	82%	.72
2	" "	1.05	25%	.70
3	" "	1.11	15%	.72

TABLE VII
INCREASE IN SENDOUT POSSIBLE BY USING BUTANE MIXTURES

Amount of Original Gas	Amount of Original Gas Required Per M.c.f. New Sendout Gas	Volume of New Gas Per M.c.f. of Original Gas Sendout
1000 cu.ft. coke oven gas	800 cu.ft. using substitute No. 1 (shown in Table VI)	1250 cu.ft.†
	900 cu.ft. using substitute No. 2 " "	1110 cu.ft.†
	900 cu.ft. using substitute No. 3 " "	1110 cu.ft.†
1000 cu.ft. carburetted water gas	180 cu.ft. using substitute No. 1 (shown in Table VI)	5560 cu.ft.*
	750 cu.ft. using substitute No. 2 " "	1333 cu.ft.*
	850 cu.ft. using substitute No. 3 " "	1180 cu.ft.*

† One MCF of amount shown is the original coke oven gas.
* One MCF of amount shown is the original carburetted water gas.
Note: Substitute gases assumed available from sources independent of original gas making capacity

TABLE VIII
USE OF LP-GASES BY MANUFACTURED GAS COMPANIES

Name	Kind of LP-Gas	Method of Use
Allentown-Bethlehem Gas Co.	Propane	Used for enriching coke oven gas when heating content falls below 520 B.t.u.
Central Hudson Gas & Electric Corp.	Propane	Restoring B.t.u. lost by under-Hudson transmission line.
Connecticut Light and Power Co.	Butane	Reformed in generator fire.
Haverhill Gas Light Company	Propane	Restoring B.t.u. lost in high pressure transmission main.
Illinois-Iowa Power Company	Butane	Enriching 565 B.t.u. mixed gas.
Nashville Gas and Heating Company	Normal Butane	Cold enrichment of coal gas for emergency only. (Only used experimentally so far.)
Peoples Light Company* Davenport, Iowa	Butane	Enricher in place of gas-oil.
Coke Oven Plant near Buffalo, N. Y.	Butane-Propane Mixtures	Mixed with flue gases for underfiring coke ovens.
Hudson Valley Fuel Corp. Troy, N. Y.	Butane	Cold enrichment of blue water gas to supplement coke oven base load gas. Primarily for winter peaks.

* Now on natural gas; former operating data available.

The composition of actual city gases undoubtedly differs from that used for typical compositions in the test work which was done by the American Gas Association and, therefore, the suggested limits of usefulness given in Tables VI and VII must be considered in this light.

Table VI shows the quantities of substitute butane gas mixtures which can be theoretically mixed with either coke oven gas or carburetted water gas without requiring any readjustment of consumers' appliances. If the peak loads requiring additional substitute gas are of such short duration that it is unlikely for gas appliances to be installed during that period, then the limits of quantities shown could be extended somewhat. Three butane substitute gas mixtures are shown using blue gas, producer gas, and air as the diluting agents. These substitute mixtures are designed to have the same heating value as the original gas. It is also possible to devise other combinations of these mixtures having slightly higher heating value than the original gas which would be suitable for short period augmentation of gas supplies, although the consumer would get more Btu. than the standard during the peak load period. Such mixtures of this character are described in the Mixed Gas Research Reports but have not been used by any of the gas companies reported in this survey.

Table VII shows the increase in

sendout made possible by using butane mixtures which are illustrated in Table VI. While the substitute gases are assumed to be available from sources independent of the original gas making equipment, nevertheless an important increase in gas capacity may be secured through the use of LP-Gas mixtures. This is particularly true of butane-blue gas mixtures, replacing carburetted water gas, which would readily permit an increase in capacity from 6% to 8% without cracking the butane and a substantially greater amount if part of the butane is cracked in the generator fire. Careful analysis of the test work done by the American Gas Association shows that limits of interchanging various gases cannot satisfactorily be resolved to a basis of specific gravity variation. The chemical composition is a most important factor, and if it does not correspond to those used in the American Gas Association tests, the limits must, of necessity, be modified accordingly.

In the present survey, nine manufactured gas companies using LP-Gases reported their practices. None of these companies utilize the three types of butane gas mixtures illustrated in Tables VI and VII. The primary use of LP-Gases by manufactured gas companies has been for enrichment purposes to bring the B.t.u. value of their gas up to the required standard.

A battery of underfired coke ovens in Western New York State utilizes coke oven gas for normal heating. For peak demands, LP-Gas can be diluted with stack gas to a heating value equal to the normal coke oven gas. This product is then used in place of coke oven gas for underfiring the ovens, and an equivalent amount of coke oven gas is thereby released to meet the peak demand. The equipment has not been operated frequently enough as yet to permit the collection of reliable, detailed operating data, but the scheme is similar to that tried at Waukegan, Ill., several years ago.

In the case of the Connecticut Light and Power Company, LP-Gases are used in the Waterbury plant by means of reforming butane in the generator fire. The details of this process are described by Alfred I. Phillips in the April, 1941 issue of the American Gas Journal, listed in the bibliography. Liquid butane is admitted at the down-stream connection of the generator during the down-run. In passing through the generator fire together with the down-steam, the butane is partially reformed, resulting in down-run gases containing illuminants, methane, ethane, and a high percentage of hydrogen. In connection with the introduction of butane during the down-run, ⅔% blow-run is carried. The combined effect of blow-run and butane reformation is an increase in set capacity from 24% to 36%. Butane is also admitted during part of the uprun for supplementary enrichment inasmuch as the carburetor and superheater are limited in enriching capacity. This uprun butane is likewise introduced at the down-steam connection of the generator, passing substantially unchanged through carburetor and superheater. The specific gravity of the gas is 6% higher when operating at maximum capacity, but the standard B.t.u. content is maintained, and there are no obvious changes in the combustion characteristics of the finished gas.

The Hudson Valley Fuel Corporation has installed 50,000 gallons of butane storage capacity for applying butane for cold enrichment of blue gas when required for peak load or emergency service. This company primarily manufactures coke oven gas of 540 B.t.u. but has blue gas equipment for the dual purpose of underfiring one of its coke oven batteries and, in the winter time, for diluting coke oven gas to meet peak loads.

Normal winter loads requiring added gas facilities are met first by changing from producer gas to blue gas dilution and then by replacing the underfiring coke oven gases with producer and blue gas respectively. Extraordinary peaks are satisfied by cold enriching added quantities of blue gas in the sendout gas with butane. This practice has been followed since 1935, and under normal circumstances, the blue gas is enriched to the regular 540 B.t.u. standard.

Butane enriched blue gas has the important advantage of being almost instantly available and so is very suitable for meeting the sharp peaks of the fluctuating winter load of the Hudson Valley Fuel Corporation. The operation of the blue gas plant is not disturbed for butane operation as would be the case in carburetted water gas operation which among other things would require for each peak, installation of oil sprays, by-passing waste heat boilers and rebalancing the sets for carburetting.

In the year 1939, a serious coal strike threatened the continuity of gas supply. It became necessary to reduce the coke oven capacity to one third of normal in order to extend the period over which the gas-coal stocks would be needed. In this emergency, larger percentages of butane-enriched gas were employed, and to minimize customer complaints, it was found necessary to raise the B.t.u. of the coke oven gas—blue-gas-butane mixture to 590 B.t.u. Those customer calls which resulted from the changing character of the gas were primarily in the domestic field.

Table VIII summarizes the use of LP-Gases by manufactured gas companies.

[6] *Practical economics rather than technology is undoubtedly the reason for the selection of air as the carrier gas judging from this mathematical exploration of the facts.*

[7] *Private Memo: Frank Wills, Pacific Gas and Electric Company.*

Selected Bibliography on Use of LP-Gases by Gas Utility Companies

This bibliography has been selected to include the articles considered to be of greatest informative value in connection with the practical use of LP-Gases by utility companies. Comprehensive bibliographies covering all phases of the LP-Gas industry are available, but they include hundreds of titles not germane to the present subject.

Brief abstracts of the articles are given below each title. The articles have been grouped according to date of issue.

Combustion Experiments with Liquefied Petroleum Gases. Frank Knoy. *Gas*, June, 1941, pages 14-19.

Practical relationship between Sp. Gr. and Heating Value of LP-Gas-air mixtures for determining satisfactory appliance operation. Experimental verification of proposed method with many charts and tables.

Meeting Peak Loads and Other Technical Developments. A. I. Phillips. *American Gas Jrl.*, April, 1941, pages 15-18+.

Material relating to reformed butane (pages 17 and 18) furnishes operating results at Waterbury, Connecticut. Effect of introducing butane directly on generator fire through down-steam connection is described. Cost data are given.

Standby Plant at Long Beach, California. E. S. Bryant, H. W. Wickstrom, M. A. Nishkian. *Gas*, February, 1941, pages 21-27.

Reasons for adoption of high B.t.u. butane-air (Specific Gravity 1.44-1.52) standby plant. Need for peak load gas supply. Contracts with suppliers of natural gas. Contrast of all methods of meeting peak demands. Size and design of plant. Capacity 500,000 cu. ft. of equivalent natural gas per hour. Air-mix and control. Safety features. Construction history of plant.

Limits of Flexibility of Gas Appliances Operating on Natural Gas. R. M. Conner. A.G.A. Distribution Conference, May, 1940.

While not specifically directed at LP-Gases, this paper is of greatest value in studying the technology of interchanging gases. It condenses the more extensive treatment of the same subject, given in Bulletin No. 10, "Research in Fundamentals of Atmospheric Gas Burner Design" published March, 1940.

Production of High B.t.u. Gas Using Butane in a Water Gas Machine. Report of Peak Shaving Committee, L. A. Kirch, Chairman, and F. T. Carpenter. Indiana Gas Association, May 8, 1939.

Substitute for natural gas to be used inter-

changeably. Used high B.t.u. oil gas for carrying part of peak load but troubles were encountered with carbon and tars. Tests on appliances with new experimental butane gases. Description of field experiments comparing customer complaints with oil gas vs. butane-enriched blue gas substitute with as much as 75% of latter in send-out gas. Complete analysis showing per cent of each constituent in the illuminants. Recommendation for further work. Tables of appliance testing results.

The Southern Counties Gas Company Butane-Air Standby Plant. A. F. Bridge and F. A. Hough. Proc. P.C.G.A. 1939, pages 112-119.

Safety and simplification of control of butane-air standby plant to replace natural gas utilization test data to determine proper replacement gas. Description of a plant and accessories, especially fire prevention and control units. Results of operating trials and comparison of cost with alternative type of standby plant. Possible use of butane-air to carry peak loads.

Butane-Air Standby Plant, Colusa, California. H. J. Smith. Proc. P.C.G.A. 1939, pages 108-111.

Replaces oil-gas plant used until advent of natural gas in 1938. Butane-air made by Gasair mixer and vaporizer. Charts show operating characteristics of this equipment.

Butane-Air Standby Plant of the Coast Counties Gas & Electric Company at Santa Cruz. A. R. Bailey, Proc. P.C.G.A., 1938. Also in *Gas*, October, 1938 (Abstracted), pages 68, 69.

Substitute for natural gas in case of interruption of supply. Heller inspirators to make butane-air mixtures. Tests showed that 1670 B.t.u. was best practical substitute for 1200 B.t.u. natural gas. Flames nearly similar in appearance. Gas is not required for industrial processes needing exact duplication of heat input.

Liquefied Petroleum Gas Plants for Natural Gas Standby. L. R. Pickup. Proc. P.C.G.A., 1938, pages 128-132. Also *Gas Age*, September 1, 1938, pages 21-24+.

Substitute gas for industrial customers having interruptible or dump gas contracts. Details of propane and butane-air installations in laundry, bakery, ceramic plants, etc., B.t.u. of best substitutes shown.

Butane As a Substitute Gas and Standby Gas. P. C. DeHaan. Midwest Gas School, Iowa State College, November, 1936.

Discussion of economics leading to choice of butane to enrich manufactured gas to mix with natural gas. Analyses of various mixtures distributed given in table. Quantitative data on oil and butane limitations.

The Use of Butane in Water Gas Sets for Producing High B.t.u. Gas. E. L. Fischer. A.G.A. Joint Production and Chemical Conference, May, 1935.

Substitution on short notice dilute butane with low gravity water gas made by passing oil through generator fire. Various mixtures of generator oil-gas, carburetor oil-gas, and butane were compiled and checked by the American Gas Association formula for substitute gases.

Butane added during pump over from relief to storage holder. Resultant gas fair. Further tests made by cracking butane in carburetor with increasing temperatures in bottom of superheater. At this point, it was decided to mix blue gas or low gravity gas resulting from oil or butane through the fire with the cracked butane-gas. Resultant gas satisfactory in the main. Both methods can be used successfully.

Handbook of Butane-Propane Gases, Second Edition, 1935.

General information, tables of constants, directory of manufacturers, etc.

The Use of Propane and Butane by the Gas Industry. W. Z. Friend. *American Gas Journal*, May, 1934, pages 69-72+.

General survey covering butane-air service for small towns, properties of LP-Gases and early experience in peak load applications.

Reformed Butane for Emergency and Peak Load Gas. W. F. Faber, *Gas Age Record*, June 18, 1932, page 759.

Discussion of the "Davis Reforming Process" to convert butane in water gas equipment. Description of the process and claims of advantages. Nickel wire catalyst employed.

Mixed Gas Research Investigation Report No. 645, A.G.A. Testing Laboratories, 1932.

Utilization of butane-air and mixtures of butane and various city gases employed to meet fluctuating demands.

TABLE IX

HEATING VALUES OF GAS OBTAINED BY PARTIAL SUBSTITUTION OF PROPANE-CARRIER GAS MIXTURES FOR NATURAL GAS. "C" FACTOR HELD CONSTANT AT 1.0

		Replacement Gas				
Per Cent Natural Gas	*Per Cent Replacement Gas*	*Propane-Reformed Natural Gas*	*Propane-Coke Oven Gas*	*Propane-Blue Gas*	*Propane-Producer Gas*	*Propane-Air*
100	0	1116	1116	1116	1116	1116
90	10	1133	1137	1154	1163	1168
75	25	1158	1168	1210	1232	1245
50	50	1203	1222	1306	1351	1375
25	75	1247	1275	1400	1469	1506
0	100	1290	1328	1495	1585	1635

TABLE X

"C" VALUES OF GAS OBTAINED BY PARTIAL SUBSTITUTION OF PROPANE-CARRIER GAS MIXTURES FOR NATURAL GAS. B.T.U. PER CUBIC FOOT HELD CONSTANT AT 1116

		Replacement Gas				
Per Cent Natural Gas	*Per Cent Replacement Gas*	*Propane-Reformed Natural Gas*	*Propane-Coke Oven Gas*	*Propane-Blue Gas*	*Propane-Producer Gas*	*Propane-Air*
100	0	1.000	1.000	1.000	1.000	1.000
90	10	....	0.972	0.947	0.922	0.908
75	25	....	0.942	0.880	0.831	0.798
50	50	....	0.876	0.781	0.710	0.668
25	75	....	0.827	0.695	0.615	0.558
0	100	0.837	0.796	0.619	0.544	0.496

The Use of Butane for Peak Load Production. Report of Committee, J. A. Harritt, Chairman. *Western Gas*, August, 1931, pages 73-74.

Ten day test at San Diego, California, in August, 1930, during which lean oil-gas was enriched with butane. Results indicated that safe net yield of gas could be increased 21% at an increase in cost of finished gas of 1.4c per M cu. ft. with butane at 6c per gal.

Results in other places briefly summarized also. Adapting Appliances Designed for 550 B.t.u. Oil-gas to 550 B.t.u. Butane-Air Mixtures, F. M. Cota, C. E. White, and W. E. Daynes. *Western Gas*, July, 1931, pages 49-51+.

Experimental work to determine feasibility of replacing oil-gas at Escondido with butane-air. Tests on various appliances.

The Use of Butane in Meeting Peak Load Conditions. E. W. Evans. *American Gas Journal*, May, 1931, pages 50-53+.

Theoretical aspects of appliance operation with LP-Gas peak load mixtures. Effects of specific gravity, heating value and chemical composition changes.

Peak Load Production Economies Through Use of Butane. J. A. Harritt, *Western Gas*, December, 1930, pages 39 and 40.

Summary of economics of LP-Gases for peak loads. Report includes data from Tucson, Arizona, El Centro and San Diego, California, and Oceanside plant of San Diego.

Enriching Oil-Gas with Butane at Tucson, Arizona. C. H. Webber. *Western Gas*, November, 1930, page 28+.

Requiring extra gas capacity just as natural gas was about to be brought to Tucson, Arizona, a butane-enriching installation was made. Lean oil-gas (400 B.t.u.) is brought up to 500 B.t.u. by butane. Operating data given. Also notes on decrease in tar and lampblack when making lean gas. Cost of operation shown.

The Use of the Low-Gravity Water Gas Process and Butane Enrichment for Meeting Peak Loads. J. F. Duesler. A.G.A. Proc., 1929, pages 834-854.

Louisville, Kentucky, is served with natural gas plus various manufactured gases during the peak season (150 B.t.u. steam producer to 600 B.t.u. carburetted water gas available). Butane enriched low gravity water gas (Willien-Stein Process) used to meet additional peak loads since 1928. Detailed operating results are given. The Use of LP-Gas as an Enricher for Blue Gas in Place of Gas-Oil. E. L. Fischer. A.G.A. Proc. 1929, pages 1299-1307.

Details of cold carburetion at Davenport, Iowa. Consideration of economics of butane and technology as well as practical phases of various gas making cycles to produce suitable gas for mixing.

Use of Hydrocarbon Enricher at End of Transmission Line to Offset Thermal Losses Due to Compression and Transmission. G. E. Hitz. Enrichment of Gas after Transmission by High Pressure. H. W. Schell. A.G.A. Proceedings, 1929, pages 1315-1327.

Two similar installations, Beacon, New York, and Haverhill, Mass., for restoring B.t.u. value to proper standard. Experiments with butane and propane, gasoline, pentane, etc.

Commercial Propane and Butanes in the Manufactured Gas Industry. R. W. Thomas and O. M. Setrum. A.G.A. Proceedings, 1928, pages 1284-1301.

General survey of development and status of LP-Gases. Brief outline of the Muscatine, Iowa, tests by the Bureau of Mines and the subsequent large-scale test of cold carburetion of blue gas at Davenport, Iowa.

New Developments

(Continued from page 46)

4. "Recovery of Tar Bases in a By-Product Coke Plant," by H. J. Meredith, Chief Chemist, Koppers Company, Seaboard Division, Kearny, N. J.
5. "Co-operative Training of Technical Men," by Prof. W. E. Nightingale, Director of Co-operative Work, Northeastern University, Boston, Mass.

Also attached to this report is a paper on:

6. "Oil Gas Generating and Recovery Plant," at the Seattle Gas Co., Seattle, Washington, by G. R. Horning, Chief Engr. and Gen. Supt.

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